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## PLEUROPNEUMONITIS FOLLOWING X-RAY TREATMENT, AND DIFFUSE METASTASIS TO THE LUNGS FROM CANCER OF THE BREAST<sup>1</sup>

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**T**HAT exposure of the thorax to X-rays may, under certain conditions, be followed by pleural and pulmonary reaction can no longer be doubted. The attention of the profession was drawn to such reaction in 1922 by Groover, Christie and Merritt, Case, Hines, and Tyler and Blackman. Since that time other contributions have appeared, in several of which are cited case reports tending to prove that the pleuropulmonary changes were actually an effect of the X-ray treatment administered, usually to patients with cancer of the breast.

My own experience has long since convinced me that, in a small percentage of cases in which the thorax is subjected to X-ray treatment, definite inflammatory phenomena follow. This has been observed not only in cases of cancer of the breast, but also in a few cases of quite different conditions. However, of the total number of cases so treated, definite evidence of reaction has appeared in only a very small proportion.

Many radiologists have termed this inflammatory reaction "pulmonary fibrosis," but this is a misnomer, because it describes only the final phase of the reaction; indeed, in many cases the condition never reaches a degree of intensity sufficient to lead to permanent fibrotic changes. In their second communication, Groover, Christie and Merritt cite a case in which definite pleuro-

pulmonary changes occurred after, and apparently as the result of, X-ray treatment. Their clinical description and thoracic roentgenograms support their deduction, except in one particular. After they had demonstrated repeatedly that the intrathoracic changes led to fibrosis, their last observation and roentgenogram showed the pleuropulmonary reactive process to have disappeared. As we all know, a lesion that once reaches the stage of true fibrosis does not thus disappear, but leaves a scar as permanent evidence. The occurrence of the changes described by these authors is not questioned, but only their use of the term "fibrosis," which is misleading, since in many cases the reaction to X-rays is not sufficiently intense to lead to scar formation. It would be more appropriate to call this phenomenon X-ray pleuritis, or pleuropneumonitis.

### PLEUROPNEUMONITIS FOLLOWING X-RAY TREATMENT

*Symptoms.*—The symptoms of pleuropneumonitis generally appear from two to four weeks after a course of X-ray treatment, and consist of cough, shortness of breath, and sometimes fever; the cough, irritative and non-productive in character, is frequently paroxysmal and quite distressing. Often it begins suddenly and the patient thinks she has "caught cold." The dyspnea, varying with the degree of the

<sup>1</sup>Read before the Radiological Society of North America, Kansas City, December 8, 1924.

pulmonary irritation and with the activities of the patient, may be slight or quite pronounced. When fever is present, it subsides within a week or two; many patients never have fever. Intrathoracic pain is an occasional complaint, but is seldom sufficiently severe to be considered an outstanding feature. Weakness is usually proportionate to the degree of dyspnea and cardiac embarrassment. Hemoptysis is quite rare. A definite increase in the pulse rate is common, and, coming on rather suddenly with the onset of the other symptoms, is often noticed by the patient. A burning sensation in the chest is an infrequent subjective manifestation.

The acute phase of the symptoms subsides in from one to three weeks, but cough and dyspnea may persist in some degree for weeks or months. In many cases the symptoms completely disappear in a short time, but later, if the patient is submitted to further roentgenization, they may return in a more severe form; under such conditions the cough, dyspnea, weakness and increased pulse rate may continue indefinitely, the pulse rate and weakness diminishing slowly as the remaining lung tissue adapts itself to its new functional requirements, and as more or less of the injured lobe or lobes recover their normal activity.

Except during the acute stage of the process, the general condition of the patient is little influenced as a rule, but the activities of the victim frequently have to be curtailed on account of the dyspnea.

*Physical signs.*—The physical signs vary considerably, depending on the degree, extent, and location of the pleural or pulmonary tissue injured. As a rule, these signs are limited to one side: in the case of cancer of the breast, to the side of the amputated breast, while in other conditions they are confined to the side receiving the strongest dose. During the acute stage, dry and moist râles in all degrees of pitch and volume can be heard over the affected lung. A distinct pleural rub is sometimes audible. Evidence of pulmonary infiltration may be elicited, this naturally depending on the depth and degree of the infiltration. Pleural

effusion is known to occur, but only in the more severe grades of irritative inflammation; in the majority of cases it is not sufficient to be recognized clinically or roentgenologically.

As the acute manifestations recede, the râles, as well as the other auscultatory and percussion signs, disappear completely or diminish to a large extent, but evidence of chronic pleuritis commonly persists in the form of adhesive bands or more or less extensive symphysis of the pleural layers. Interference with the diaphragmatic excursion on the side of the lesion is a common sequel. If sufficient pulmonary tissue has been involved, a varying degree of functional impairment results, leading to compensatory emphysema of the remaining pulmonary parenchyma.

*Roentgenologic signs.*—During the early phases the roentgenologic signs may consist merely of the diffuse fog of inflammatory pleural thickening, with or without the still more dense shadow of effusion, or they may simulate fairly closely those of the focal type of pneumonia so commonly seen after influenza. This may begin at, or near, the hilus, or the area of infiltration may be located well within the lung fields. The infiltrated zone may quickly reach its maximal extent and density, and then progressively clear up, or the process may be more gradual and extension continue over a longer period, in which case the changes are more likely to leave permanent marks. Since the site of such infiltration must necessarily depend on the conditions of the X-ray treatment, the relationship of any pleuropulmonary process to X-rays as a possible cause must take into consideration the coincidence of cause and effect in the same territory. The zone of infiltration is generally irregular in outline and density; indeed it may have some of the earmarks of an abscess; however, there can be no confusion from the point of view of symptoms and clinical signs. If the infiltration is central and sufficiently extensive to interfere with the free passage of air toward the periphery of the lung, the lobe or lobes so hampered in their function collapse more

or less. Whether or not partial or complete expansion will occur subsequently must depend on the degree of permanent pulmonary impairment and functional interference. Gradually the infiltration shadow becomes less dense, and when this clearing process reaches a certain point, one becomes conscious of a more or less distinct pleural thickening and adhesion to the parietes or the diaphragm on the affected side. This limits respiratory excursion and efficiency. The infiltration may entirely disappear if the irritation has been relatively slight, but the cases which have stimulated our present interest in the problem are precisely those in which a variable degree of permanent alteration in the density of the lung tissue has remained as evidence of the injury. Such alteration usually consists of irregularly arranged strands of varying density, producing a distinct change in the architecture of the lung field and disturbance of the normal markings. In some cases the final picture gives the distinct impression of scar formation, while in others this impression is more or less blurred by the superimposed pleuritis which may be limited to the basal, peripheral, or interlobar portions. Deviation of the mediastinal structures toward the affected side, and fixation and elevation of the corresponding leaf of the diaphragm are often observed.

So much for the more typical cases. But the roentgenologic picture is often decidedly confusing; so much so, indeed, that he would frequently be rash who would venture to make a definite diagnosis between X-ray pleuropneumonitis and pulmonary metastasis from a single examination. Sometimes the infiltrative shadow is so mottled as to simulate certain forms of lung metastasis. Often one must keep the patient under periodic observation and make several roentgenographic examinations before one can feel reasonably certain of his ground. This is all the more important when the roentgenologist makes his interpretations without any knowledge of the clinical aspects of the case. I make it a

point to mention this because a hasty roentgenologic diagnosis may work an injustice to the patient. Inasmuch as the present-day clinician depends to a considerable extent on the roentgen findings in making his estimate of the patient's condition, so far as the intrathoracic structures are concerned, it is of the utmost importance that he receive no impression that does not rest on solid ground.

*Mechanism.*—Now what is the mechanism of this pleuropneumonic reaction to X-rays? Most of the authors who have written on the subject seem to have had the impression that it is in some way related to the use of X-rays of shorter wave length, either generated at high voltage or filtered through 0.5 mm. or more of copper. As a matter of fact the effective wave length has little to do with the problem, the chief factor being the dose. By this I mean that pleural and pulmonary reactions are more likely to supervene as the dosage reaches, or passes beyond, the point of skin tolerance. In other words, if the dose is such as to produce a strong skin reaction, the pleura and lungs also are very likely to be irritated. Reaction may occur whether the dose is administered at 200 peak kilovolts with 1 mm. of copper as filter, or whether at 135 peak kilovolts with 6 mm., or even 4 mm., of aluminum as filter. This is particularly true in the post-operative treatment of cancer of the breast, because the thickness of the remaining tissues of the chest wall is not sufficient to make much difference between the dose received by the skin and that reaching the pleura and lungs. Thus we find pleuropulmonary changes almost always on the side of the amputated breast, even when both sides of the thorax have been equally treated. Exceptions to this are occasionally seen in undernourished women with very small breasts. Pleuropulmonary reaction in patients being treated for lesions other than cancer of the breast has likewise occurred, but only when the chest wall was thin, or when the X-ray dose was exceptionally strong. According to my experience, such reaction never oc-

curs after the first course of X-ray treatment, and seldom after the second, but if further treatment is given with full dosage, manifestations are more likely to appear.

#### PULMONARY METASTASIS

The clinical and the roentgenologic determination of carcinomatous invasion of the lungs often constitutes an extremely puzzling question. Pulmonary metastasis is to roentgenology what appendicitis is to surgery; that is to say, it may be the simplest or the most difficult and perplexing of problems. Some forms of metastatic involvement are so strikingly characteristic that the merest tyro can recognize them at sight; others require all the visual and mental acuity of the keenest and most experienced of roentgenologists, especially during the earlier stages of the process when symptoms are so few and slight that the patient does not attach any significance to them, and when physical signs are absent or so ill-defined that the clinician is more or less in doubt.

In a comparatively recent communication, Craver describes the physical signs of early pulmonary metastasis as consisting of "a peculiar limitation of breath sounds, especially marked during inspiration, covering a limited area of the chest. This may or may not be accompanied by fine crackling râles during inspiration, or by pleural friction rubs." No doubt this is true in some cases, but in others no physical signs can be elicited, and the first inkling of secondary invasion of the lung is in the more or less characteristic appearance of metastatic foci in the thoracic roentgenogram. It is only fair to add, however, that sometimes the roentgenogram yields no clue, even when there are fairly suggestive clinical manifestations.

*Symptoms.*—The onset of the symptoms of pulmonary metastasis depends largely on the number, size, and location of the metastatic foci, if the process is focal, or on the degree of functional interference, if the process is diffuse. It is not uncommon to see patients with the former type, whose

lungs are actually the seat of multiple nodules of considerable size, and yet who are not conscious of any symptom. This can only be explained by the relationship of such nodules to the bronchi and to the larger vascular radicles. In the diffuse form, subjective disturbances and physical signs are more likely to supervene before the roentgenologic features are sufficiently distinct to be clearly recognized. As described by Lee and Herendeen, these symptoms usually consist of shortness of breath, and a dry, hacking cough with little or no expectoration. "The onset of the cough is frequently sudden (the patient stating that she caught cold on a certain day), and from that time on cough and shortness of breath progressively increase." Weakness, and a moderate increase in pulse rate are also common subjective manifestations. The latter is generally less pronounced and makes less impression on the patient than in the X-ray reaction, probably because its more insidious onset allows compensatory adaptation. Whatever its cause, the difference is hardly sufficient to constitute an important differential sign. Pleural effusion is more common, and aspiration usually produces characteristically blood-tinged fluid if the condition is pulmonary metastasis.

On comparing the symptoms of pleuro-pulmonary reaction to X-rays with those of lung metastasis, one is impressed by their similarity, which often makes their distinction at a single examination difficult or impossible. Only by observing the course of events, by repeated clinical and roentgenologic examinations, can one become certain of the actual state of affairs.

*Physical signs.*—While frequently suggestive and occasionally fairly well defined, the physical signs of beginning pulmonary metastasis seldom furnish sufficient evidence to enable the clinician to estimate the situation accurately without other corroborative clinical and roentgenologic data. Even with these, he must often remain in doubt until the more or less steady progress



of the disease confirms his earlier impressions.

*Roentgenographic appearances.* — It is not my purpose to review the whole subject of secondary dissemination of cancer in the lungs. The focal type of metastasis, in which nodules of from 1 to 3, or even 4 cm., stand out in the lung fields like ripe plums against a blue sky, is so characteristic and obvious as to require no discussion. But I do wish to call attention to one form which is not so rare as many of us seem to think, and which can very easily be confounded, clinically as well as roentgenologically, with pleuropulmonary reaction to radiation, at least during certain stages of its development. I refer to what, for lack of a better term, I call the diffuse form of metastasis.

To quote Lee and Herendeen: "The early features of chest metastasis in the X-ray plate are not generally recognized. Often chest plates may be passed as negative where evidence of early metastasis really exists. Many roentgenologists examine such a plate for pronounced shadows, which one seldom sees save in the presence of advanced disease, although the features of early metastasis have been recognized for some time by certain observers. Other authors have stated that they fail to find this picture of early metastasis in the chest. In the larger majority of cases this evidence consists of hazy line-like streaks along the bronchi, extending in a radiating manner from the hilum out into the parenchyma of the lungs. It is usually bilateral, and is generally more pronounced on the side corresponding to the primary tumor. One may also see ill-defined mottling, which in more marked cases gives almost the appearance of miliary tuberculosis." In many cases the line-like streaks have a distinct beaded, finely segmented appearance; in others, the streaks are less evident, the fine beading or speckling being irregularly distributed about the field. Many of these cases undoubtedly represent the type of carcinomatous invasion of the lungs, misleadingly designated "lymphangitis carci-

nomatosa" by Assmann, Handley, Kaufmann, Aschoff, and other authors.

#### DIFFERENTIAL DIAGNOSIS

It will at once be recognized that the roentgenologic features, while very suggestive in many cases, are not often sufficiently clean-cut to permit of a confident diagnosis at a single examination. Indeed, it is this very point I wish to emphasize. Much more important in distinguishing between metastasis and a pleuropulmonary X-ray reaction, for instance, is the fact that in the former the process is generally bilateral, while in the latter it is generally unilateral. In the X-ray reaction there is a tendency to retraction of the injured lung and of the mediastinum toward the affected side; one lobe or the entire lung may be partially or completely collapsed, and the symptoms tend to subside, but even when the cough and dyspnea persist, the patient's general condition often remains surprisingly good. In extremely rare cases the X-ray irritation might conceivably be sufficiently intense to overtax pulmonary function and lead to death. Pulmonary metastasis progresses uniformly, although not always at the same rate. As the disease advances, the general health fails.

My purpose in laying this subject before you and in calling attention to its different aspects is to stimulate more interest in it, and to persuade both clinician and roentgenologist not to jump at hasty and unscientific conclusions on an insecure foundation. Our knowledge of the protean manifestations of cancer is none too great as it is; if we would increase it, we must study its various forms and phases with the utmost care. The clinician, the roentgenologist and the pathologist must pool their efforts and compare their findings. Post-mortem examinations supplemented by thorough microscopic study should soon throw a world of light on the problem. Gross appearances alone are misleading, in that diffuse, widespread metastatic invasion of the lungs may be present and still not be discernible with the naked eye.

Ewing asserts that Gross, from 423 necropsies, deduced the fact that the pleurae were involved in metastasis from cancer of the breast in 50.9 per cent of cases, and the lungs in 49.9 per cent. Handley, in his very stimulating monograph, estimated the frequency of pleural dissemination at 38 per cent. Since secondary pleuropulmonary carcinoma is relatively common in cancer of the breast, it behooves us to study it more closely; thus, we may learn to distinguish it early from other pathologic conditions of the lungs.

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## DISCUSSION

DR. B. H. ORNDOFF (Chicago): Discussing this very important paper there are a few points that have been emphasized in my experience. In some experimental work being conducted with Dr. A. C. Ivy at the University of Chicago, the tendency to fibrosis, not only of the lung, but of the pancreas and other organs, has been noted as a radiation reaction. Intensive radiation, for example, a human erythema dose, has caused in a large percentage of animals a fatal pleuritis and pulmonitis. Animals that have survived the acute changes have later shown fibrosis in the important viscera.

In our clinical experience we have not encountered a case where the acute reaction was fatal. In a few cases the chronic reaction with fibrosis has been apparent and I have been able to secure postmortem findings where the character of generalized fibrosis and atelectasis simulated very closely the fibrosis noted in the animals; I am confident it is radiation reaction. At present I am observing cases where practically the entire pulmonary area on one side is obliterated, the mediastinum and its structures are misplaced to the affected side. Some of them had sufficient pleuritis without adhesions to permit pleural effusions and lung collapse. In some of these cases it has been a decided relief to replace the fluid with gaseous media. The fibrosis and subsequent contraction, with atelectasis, seems to be a progressive condition and in one instance the postmortem findings indicated that circulatory disturbance from interference with the heart and mediastinal arteries was a large factor in the cause of death.

I believe that as radiologists great caution is demanded in prescribing a technic of deep therapy for breast malignancies. This caution may well be carried to other

segments of the body where large depth dosages are instituted. We must avoid substituting one serious condition for another as far as possible. This can be done when the amount of radiation absorption in the deeper viscera is not allowed to be too great.

DR. L. R. SANTE (St. Louis): I am quite sure that pulmonary fibrosis and pleural reaction follow intensive deep radiation. I am mindful of a case, at this moment, that we had some two or three years ago, when the attention of radiologists was first brought to this matter, in which a radiation of a breast tumor was done in the following manner: We had the surgeon map out with a silver nitrate stick (in order to produce a black mark on the skin), the exact amount of skin he intended to take with the tumor; then, cutting a pattern of this area, we blocked it out with lead foil and gave a very intense radiation to the remaining part which was to be taken out. The mistake we made was to use rather penetrating rays, not realizing the damage we were going to do to the underlying lung structure. The patient was operated on within the hour, and the surgeon was instructed to take all of the black part of the silver nitrate mark so as not to leave any of the skin that had been radiated; incidentally there was primary union and the patient went along all right. About six weeks later, however, she suddenly "blew up" with a tremendous pleuritis. Marked thickening of the pleura and finally a pleural effusion resulted, and she was left with permanent scars in the lung. Having had this experience, we ran into several cases of apparent fibrosis of the lung following radiation; of course we were always on the lookout for it. We obtained a significant history in some of the cases; a shadow of the affected side where the breast had been removed, associated with definite thickening of the pleura, increased markings and evidence of fibrosis, and on questioning the patient concerning all of the details of the operation, we found that in sev-

eral instances this apparently had followed the use of the cautery in the removal of the breast. It occurred to us that perhaps it would be possible to produce pleurisy, thickening of the pleura and even pleural effusion from excessive heat of the cautery in the removal of the breast, and I would like to put this as a thought in your mind, without any attempt to discredit the evidence that you can get a pleuritis from X-ray treatment, but with the idea that the cautery also can produce this undesirable lesion—not the same lesion but a pleuritis. I asked Dr. Desjardins if he had had any experience in that regard.

DR. J. F. PERCY (Los Angeles): Mr. President and members: The sequel following the use of the cautery in operations on the breast described by Dr. Sante has never occurred in my experience. I have probably done in the neighborhood of three hundred amputations of the malignant breast with the cautery knife. The larger number of cases of cancer that I see either in the breast or elsewhere are the late and often terminal stages of the disease. Those who have seen my operation will agree, I am quite sure, that it does not lack in thoroughness. The final act in my cautery knife breast operation is to press that great heating iron of mine on all of the intercostal muscles and slowly drag it from the edge of the sternum back as far as the exposed surface that I have made will permit me to go. I keep it there until these muscles are of a grayish color; in other words, they are devitalized with the heat as are also their contained cancer cells. This also frequently results in the greater or less destruction of the adjacent ribs. In one of the terminal cases that I operated on some months ago following a vicious recurrence after a previous extensive use of the X-ray, I not only completely destroyed all of the ribs on the involved side but a good portion of the sternum. The disease was on the left side and when the final sloughing was finished practically all of the ribs and a good portion of the sternum came away,

leaving the pericardium completely exposed for a space about  $4 \times 2\frac{1}{2}$  inches. This woman at no time showed any symptoms of either irritation or damage to her lung tissues. She did, however, after some months, develop an acute bronchopneumonia and died in a few days. The post-mortem disclosed no damage to the pleural cavity that could in any way be attributed to the excessive heat that was used primarily in her operation. In any early work I questioned the possibility of this accident but after repeated operations without meeting it I have assumed that this was not one of the dangers to be anticipated following the use of this method of treating cancer of the breast. It seems to me that this freedom from untoward results in the thoracic cavity is not difficult to explain. The heat produces an aseptic non-absorbing base. It is only the surface that sloughs. But under this there finally develops a wall of normal

cells that protects the underlying structures in a most efficient way.

I think that this is all that I can add in the way of discussion, to this, to me, exceedingly interesting paper.

DR. A. U. DESJARDINS (closing): I believe Dr. Percy has answered Dr. Sante's question better than I could. To my knowledge the soldering iron is seldom used in breast amputations at the Mayo Clinic.

In closing I wish to add only one point and that is concerning technic in radiography of the lungs. The technic must be such as to yield as fine detail as possible throughout the lung fields, but of the greatest importance is it that the technic in each given case be recorded and faithfully duplicated at each subsequent examination. Otherwise it is simply impossible to compare one set of films with another.

**Thoracic surgery.**—This clinical survey, together with our clinical findings, points to ligation of the pulmonary artery combined with resection of the phrenic nerve, as a method which promises an enlargement of the indications for a rational surgical procedure in advanced unilateral tuberculosis, in cases either benefited by methods now used after a great length of time or not improved at all, and so facing a dark prospect.

Other chronic inflammatory conditions of the lung, such as abscess, bronchiectasis, anthrax and even newgrowths in their early stages, might be treated, with a much brighter prospect of cure than hitherto. In an early stage the diseased organ might be put at complete rest by ligation of the pulmonary artery combined with resection of the phrenic nerve. The intact side takes over the whole respiratory function. A fibrosis occurs on the ligated side around the diseased area, in addition to the natural fibrous

envelope present in all these conditions. Thus well prepared, the diseased organ might be extirpated in a subsequent operation with a much brighter outlook than when undertaken in a one-stage operation.

This branch of surgery and its further development demands the intimate co-operation of surgeon and physician; together they must make repeated and thorough examinations of the case. Only after continuous observation and deliberation can the indications for a surgical procedure be considered and then operation should be done only by a man of experience along this special line.

W. W. WASSON, M.D.

*Ligation of the Pulmonary Artery Combined with Resection of the Phrenic Nerve in Chronic Inflammatory Conditions, Especially Tuberculosis of One Lung.* Karl Schlaepfer. *Am. Rev. Tuberc., Sept., 1924, p. 35.*



## RADIOGRAPHIC FINDINGS IN HEPATIC ABSCESS, AMEBIC IN TYPE<sup>1</sup>

By J. C. DICKINSON, M.D., TAMPA, FLORIDA

THE diagnosis of amebic abscess of the liver is always difficult, and any method of examination that will give information sufficiently definite to warrant earlier surgical intervention is of great value to the patient and will be appreciated by the clinician and surgeon.

In the literature very few references are found to the use of X-ray in the diagnosis of this condition, and these few are mostly in British or French literature; only one article, that of Mebane (1), appears in American literature.

In their discussion of the condition I am reporting, these writers bring out the same diagnostic points that I am mentioning, but none of them refer to the differential diagnosis between hepatic abscess and certain other confusing conditions.

It has been the writer's privilege during the past year to see four cases in which the radiographic findings were sufficiently definite to warrant a diagnosis of abscess in the right lobe of the liver, and in some of the cases, at least, surgical intervention was resorted to and the abscess drained at an earlier date than otherwise would have been the case.

These cases were all amebic in type, and for this reason my conclusions are based entirely upon abscesses of this character. I believe, however, that in the main they would apply to hepatic abscesses of any type other than those that are multiple.

*Method of Examination.*—The most positive evidence in these cases is to be gotten with the fluoroscope, and if possible the examination should be made with the patient erect. While plates are of value, they cannot be substituted for the fluoroscopic examination, and their principal value is for the purpose of record.

*Fluoroscopic Findings.*—The right diaphragm is elevated from one to several intercostal spaces, and its excursion is lim-

ited or entirely absent. The right costophrenic angle is increased in acuteness, and in cases in which the abscess is located near the superior surface of the liver, a rounded elevation can be seen on the superior sur-



Fig. 1. Case 2, showing elevation of diaphragm, increase in liver shadow and normal pyelogram.

face of the diaphragm. The whole liver shadow is enlarged, and in uncomplicated cases the lung fields are normally radiant. The limitation in the movement of the diaphragm is most characteristic, presenting an entirely different picture from that seen in limitation of movement due to pathology above the diaphragm, the limitation of movement in these cases being the result of rigidity, the same as seen in other abdominal muscles in acute inflammatory conditions within the abdomen.

In one article reviewed, that of P. Heyman, pneumoperitoneum is advised. While I have had no experience with this method, it does seem to me that it might, under certain conditions, be an extremely hazardous

<sup>1</sup>Read before the Radiological Society of North America, at Kansas City, December, 1924.

procedure, due to the fact that pressure of the air introduced might result in the laceration of adhesions and dissemination of the infection.

resume his previous occupation. Nine months later he was again admitted because of severe headache and distortion of visual fields. Through the aid of ventriculograms

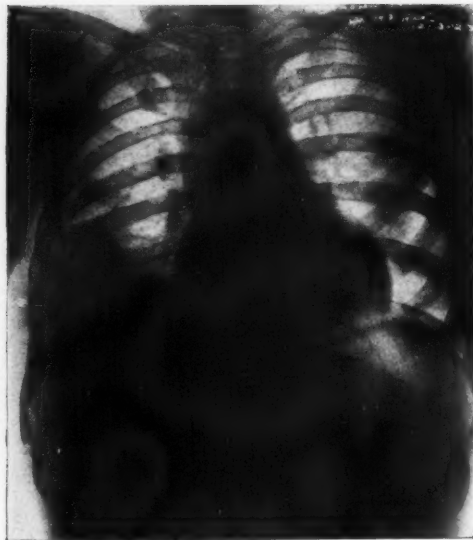


Fig. 2. Case 3, showing elevation of right diaphragm; encapsulated empyema in right costophrenic angle.

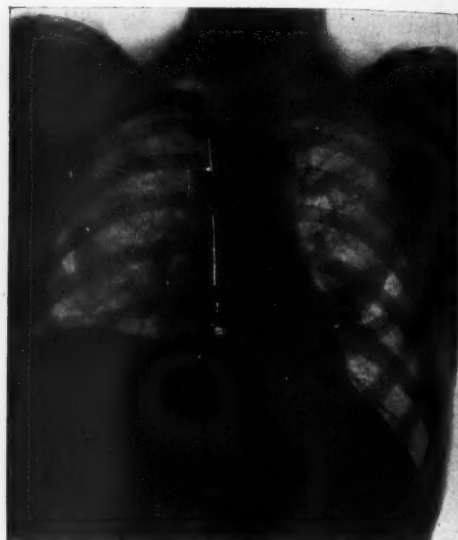


Fig. 3. Case 4, showing elevation of right diaphragm and rounded area over abscess.

Among the frequent complications of hepatic abscess is rupture through the diaphragm, either into the pleural cavity or through both the parietal and visceral pleura into the lung structure. This changes very materially the fluoroscopic picture. If the rupture is into the pleural sac, one may have either the picture of an encapsulated or free pleural effusion. If the rupture is through both parietal and visceral pleura, there is formed a circumscribed area of consolidation, which usually promptly softens, forming an abscess that ruptures into a communicating bronchus.

In one of the cases which I am reporting the abscess ruptured through the diaphragm into the pleural cavity, resulting in an encapsulated empyema. It then ruptured through the visceral pleura into the lung structure and the patient expectorated a large quantity of characteristic amebic pus, following which his condition sufficiently improved for him to leave the hospital and

an abscess was located in the posterior parietal portion of the brain, which was drained. He again improved and left the hospital, to be admitted later with a return of evidence of intracranial pressure, and died. In another case the abscess ruptured through the diaphragm into the lung structure, and the patient expectorated large quantities of characteristic amebic pus.

*Differential Diagnosis.*—The conditions most likely to be confused with hepatic abscess are pleural effusion, sub-diaphragmatic and perinephritic abscess. In empyema, the fluid level and evidence of diffuse pleural thickening, with accompanying pathology, is familiar to all and need not be dwelt upon. If, on the other hand, the liver abscess has ruptured into the pleural sac, resulting in an empyema, differentiation may be impossible until the pleural cavity has been drained. If it has ruptured into the lung structure, the localized consolida-

tion, followed by the expectoration of amebic pus, is most characteristic.

In sub-diaphragmatic abscess, there is usually a history of a previous abdominal operation or some acute inflammatory con-

the fourth interspace, palpable below the costal margin, tender to fist percussion.

*Report of X-ray findings:* Diaphragm elevated, excursion limited; right costophrenic angle acute; peripheral lung fields clear.

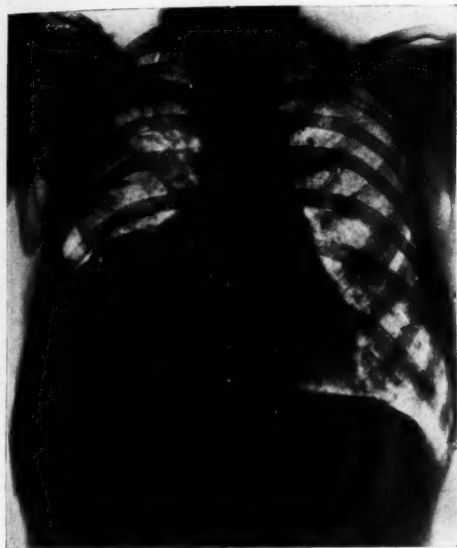


Fig. 4. Case 4, showing further elevation of diaphragm and consolidation within the lung structure.



Fig. 5. Case 4, lateral film showing drainage tube.

dition, such as acute appendicitis, perforating gastric or duodenal ulcer, while in hepatic abscess the history is usually one of gradual onset and a prolonged period of illness. In a certain proportion of sub-diaphragmatic abscesses there is a collection of gas between the dome of the liver and the diaphragm which is most characteristic; unfortunately this condition is not present in all cases.

The differentiation from a perinephritic abscess may be very confusing, and in one of our cases a pyelogram was necessary before a diagnosis could be made.

#### CASE REPORTS

**Case 1.** Mr. A. L., age 40; occupation, cigarmaker. *Chief complaint:* Weakness, fever, night sweats, over period of about two months. *Past history:* Unimportant. *Physical examination:* Liver increased to

Findings suggestive of some acute inflammatory condition beneath the diaphragm, probably hepatic abscess. Confirmed by operation. Satisfactory recovery.

**Case 2.** Mr. H. T., age 35; occupation, cigarmaker. *Chief complaint:* Pain in right lower chest and along costal margin, accompanied by chills, fever, profuse sweating, four months' duration. Was treated with ipecac with relief of symptoms for a short period, when they recurred. *Blood count:* Leukocytes, 15,000; polymorphonuclears, 85 per cent. *Working diagnosis:* Perinephritic abscess. *Report of X-ray examination:* Fluoroscopic examination of the chest shows right diaphragm to be elevated and fixed. Right costophrenic angle is acute, peripheral lung fields clear. Liver shadow increased in size. In films made of the lumbar region both kidneys could be well outlined, normal in size and position. No shadows to sug-

gest the presence of stone. A pyelogram of the right side showed the pelvis to be normal except for a slight irregularity in the filling of the upper calyx, which was thought to be due to an imperfect filling

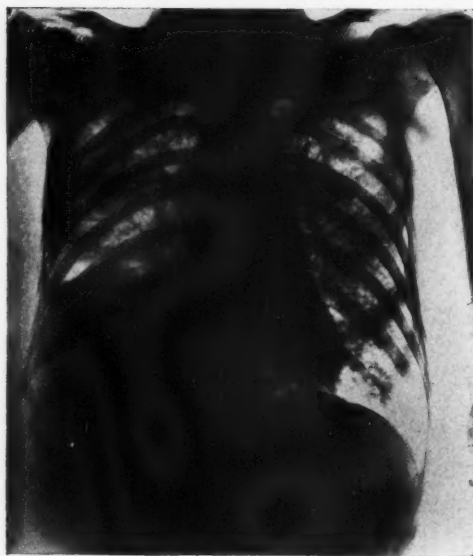


Fig. 6. Case 4, showing drainage tubes within the abscessed cavity.

rather than pathology. Findings were interpreted as indicating an acute inflammatory condition, sub-diaphragmatic in location, probably hepatic abscess. Confirmed by operation. Satisfactory recovery.

**Case 3.** Mr. P. P., Greek; occupation, merchant. *Chief complaint:* Fever, sweats, loss of weight and appetite, pain in right lower chest. *Working diagnosis:* Abscess of the liver. *Physical examination:* Heart negative; moist râles over right lung; liver dullness increased. *Blood count:* Leukocytes, 10,000; polymorphonuclears, 78 per cent. *Fluoroscopic examination* of the chest shows the right diaphragm to be elevated and fixed. There is a small amount of fluid in the right costophrenic angle. Both upper lung fields less radiant than normal. Radiograms made of the chest show a characteristic tuberculous infiltration in both upper lung fields.

Examination of the gastro-intestinal tract was negative except for the fact that the pyloric end and duodenum were displaced downward and to the left. Liver shadow increased in size. Findings were reported as being indicative of some acute inflammatory condition, sub-diaphragmatic, probably hepatic abscess.

The patient was operated on and the liver was found enlarged, symmetrical in outline, and, despite repeated attempts at aspiration, an abscess was not located. Many adhesions were found along the ascending colon and the appendix was removed. The patient continued to run a septic course.

He was re-examined three weeks later. At this time the diaphragm was found to be still further elevated and its excursion entirely absent. There was an area of consolidation in the right lower lung field, which was believed to be due to a rupture of the abscess through the diaphragm into the lung structure. The following day the patient began to expectorate quantities of characteristic amebic pus.

Re-examination one week later showed a diffuse clouding of the entire right lung field.

The patient was again operated on and a large abscess located in the upper portion of the right lobe of the liver. This was drained. He continued to grow worse, and died some time later.

**Case 4.** Mr. A. H., age 35; occupation, cattleman. *Chief complaint:* Cough, loss of weight, pain in right lower chest. *Working diagnosis:* Encapsulated empyema on right side. *Physical examination:* Heart negative, dullness over right lower chest. *Fluoroscopic examination:* Right diaphragm elevated, movement limited, circumscribed area of increased density in right costophrenic angle; lung fields clear. An opinion was given that the condition was the result of a rupture of a sub-diaphragmatic abscess into the right pleural cavity, the condition probably originating as an abscess of the liver.



Two days later the patient expectorated a large quantity of amebic pus, and immediately improved, leaving the hospital and resuming his previous occupation. He was re-admitted ten months later with the history that he had been in very good health except for a productive cough. Some three weeks previous to re-admission he began suffering with pain in the right side of the head and soon noticed that he could not see to the left; visual fields were distorted. A ventriculogram at that time showed a filling defect in the posterior horn of the right lateral ventricle. The skull was trephined and an abscess located and drained. He again improved and left the hospital, to be re-admitted six weeks later with a return of headaches, projectile vomiting, and choked disc. He died from increased intra-cranial pressure. Postmortem was not allowed.

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## DISCUSSION

DR. L. R. SANTE (St. Louis): Several years ago, before the American Medical Association, I showed radiographs differentiating sub-diaphragmatic abscesses and pleural effusions. If a very small amount of air is introduced into the peritoneal cavity, even in the beginning of the formation of the sub-diaphragmatic abscess, when the adhesions are very fine and have not attained the firmness which they ultimately

do, it has no deleterious effect whatever. We have used it repeatedly. The amount of air you need is very slight—a few pumpfuls are all that is required. I have never seen the finest inflammatory adhesion or adhesion of any other kind, ruptured by pressure from pneumoperitoneum. The process, especially in this type of case, gives a wonderful amount of knowledge. The slides shown by the essayist and his reference to differentiation from perinephritic abscesses call to my mind that pneumoperitoneum is the only graphic method that I know of, by which they can be diagnosed. The kidney outline is usually perfectly clear, even when it is bathed in surrounding pus. The differentiation between perinephritic and sub-diaphragmatic abscess is readily made. On a number of occasions we have demonstrated the fistulous tract between a sub-diaphragmatic abscess, through the diaphragm, and the lung, and thereby have given information to the surgeon which led to a complete drainage of the abscess, which otherwise could not have been done. We have, in a number of cases, eliminated sub-diaphragmatic abscess—and here, I think, is a very big field for pneumoperitoneum—we have eliminated sub-diaphragmatic involvement where it was feared that the pleural effusion, or an abscess in the lung, was connected as a result of direct extension through the diaphragm. I feel that pneumoperitoneum in these cases is a perfectly safe procedure. I would not hesitate to use it at any time, and especially so in suspected sub-diaphragmatic lesions, because one does not need very much air. I think that the additional information that it will give the surgeon in his approach to the disease, whether it be into the uninfected abdominal cavity, for drainage of a supposed subdiaphragmatic abscess, or a simple pleurotomy for the relief of a simple empyema, makes a lot of difference to the patient. We had one curious experience along this line. A man who had evidence in his chest plate of an empyema, developed a persistent hiccup over two

or three days. A pneumoperitoneum was done to determine whether he had something in his diaphragmatic space. It revealed no evidence of infection, but his hiccough stopped. I do not know whether there was anything coincidental in this—I merely mention it as an interesting feature of the case.

DR. L. T. LEWALD (New York): Dr. Dickinson spoke of making a differential diagnosis in the cases of echinococcus cyst. A number of cases have been reported, particularly from South America, and I have seen one case in which the enlargement of the liver was apparent. I think in these cases he has shown, and I know it is true in amebic abscess, that the usual location is in the upper part of the liver, and that is a differential point well brought out.

DR. J. C. DICKINSON (closing): The points brought up in the discussion were only those conditions which have been in question in these particular cases we have had under observation. The question of the cyst is one we have not had to consider, and I am very grateful to Dr. LeWald for having brought it up. There is another point I would like to emphasize, that is, that we are not in any way advancing this as the only thing necessary in the diagnosis of abscess of the liver; we simply think it is a help, and those of us who have been in contact with abscessed liver cases know that anything that can bring these cases to early operation means the avoidance of complications that are really the most disastrous consequences of the disease.

**Hodgkin's disease.**—Of the cases recorded, 29 were in males and 17 in females. The incidence of disease was greatest between the ages of 20 and 30. The process began in the supraclavicular and cervical gland groups in 34 cases, cervical and axillary in 4, axillary in 4, mediastinal in 2, inguinal in 1, and mesenteric in 1. The blood counts in many showed a platelet count above 350,000. This, coupled with an increase in the neutrophils of 10,000 to 30,000, an eosinophilia of moderate grade, and a secondary anemia of varying severity should make one suspicious of this disease. A history of tuberculosis or malignancy does not seem to be a predisposing factor.

An attempt was made to put from 60 to 70 per cent of the human erythema dose into the lympho-granulomatous tissue. The earlier treatments were given with a 140 K.V. crest value, universal Coolidge tube, and a filter of .25 mm.

copper. Later cases in the series were treated with a 200 K.V. crest value, 8 ma. and .5 mm. copper filtration. The dosage was measured with modified Dessauer charts. The time varied from 20 minutes to 2 hours, according to the type of tube used, current applied, filter, number of fields radiated and the target distance necessary to give the 60 to 70 per cent erythema dose.

The patients were made much more comfortable by radiation and seemed to have their expectancy of life much lengthened. According to the authors, radiation therapy offers the most relief in this disease with the least discomfort to the patient.

J. D. CAMP, M.D.

*Radiation Therapy in Forty-six Cases of Lympho-granuloma (Hodgkin's Disease).* Bernard F. Schreiner and Walter L. Mattick. *Am. Jour. Roentgenol. and Rad. Ther.*, Aug., 1924, p. 133.

## LIGHT SENSITIVENESS<sup>1</sup>

By W. W. DUKE, M.D., KANSAS CITY, MO.

IN previous papers I have reported a case of local urticaria caused specifically and solely by the action of light, in fact, by the action of certain rays of light, namely, those at the violet end of the spectrum. This should be of interest to roentgenologists, not only because of the peculiar phenomenon itself, but because of a bearing it might have upon burns which occasionally follow the use of X-ray in diagnosis and therapy, even when the exposure would not seem great enough to cause a burn. X-ray, when properly and cautiously administered, should not burn the skin and rarely does. The same can be said of the application of ultra-violet light or sunlight.

Patients are occasionally excessively sensitive to sunlight and react with eruptions such as hydroa vacciniforme, xeroderma pigmentosum, eczema (similar to that observed in pellagra), and occasionally with a deep urticarial rash, such as my patient displayed when exposed to light. If patients can be hypersensitive to the action of visible light or ultra-violet light, such as that described, which is perfectly definite and unmistakably true, we should occasionally meet with someone who is hypersensitive to the action of X-ray, who, upon the administration of ordinary doses, should react differently from the normal and possibly react in such a way that ulceration would result.

CASE 1.<sup>2</sup>—A married woman, aged 43, a number of whose relatives were subject to seasonal hay-fever, asthma and urticaria, had observed for four years before seeing me that the skin itched intensely and broke out with wheals whenever she was exposed to sunlight; and whenever a sufficient area of skin was exposed she became seriously ill. On one occasion, temporary blindness followed exposure of the face to sunlight.

Physical, laboratory and roentgen-ray examinations, and intracutaneous tests, revealed nothing of interest.

On testing, it was found that hives could be produced by exposure to any type of light that contained violet rays; namely, by the light of a nitrogen lamp, arc light, sunlight, or mercury vapor quartz light. The skin was unaffected by ordinary exposures to the roentgen ray or to col-

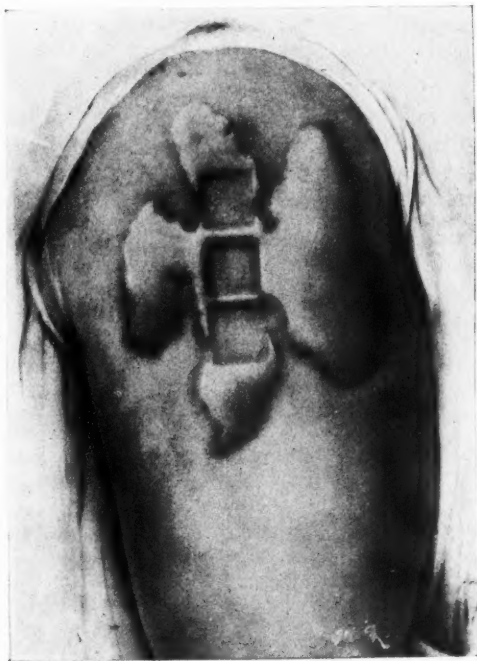


Fig. 1.—Urticaria solaris: Large area of itching edema which appeared in five and one-half minutes after exposure of the skin to sunlight for two and one-half minutes. The irregularities in the figure were due to a shadow cast by the hands holding three pieces of square colored glass in contact with the skin. The shape of the shadow cast by the hands was modified slightly by the artist to illustrate better how closely the edema followed the outlines of the colored glass. The edema did not spread beyond the area exposed to light. Sensitiveness in this patient increased at a later date, so that a thirty second exposure sufficed to produce a severe reaction. General symptoms were felt when a large area of skin was exposed. After subsidence of the reaction, further exposure of the area to light on the same day produced less or no reaction. Frequent exposure of an area gave rise to local tolerance for light, which lasted several days.

<sup>1</sup>Read before the Radiological Society of North America, at Kansas City, December, 1924.

<sup>2</sup>Reprinted, in part, by permission from *Jour. A. M. A.*, June 23, 1923, and July 5, 1924.

ored light except blue violet. Exposure of the skin for thirty seconds to summer sunlight was followed within a few moments by erythema and itching, and within five minutes or less by the appearance of a typical hive which would cover the entire area exposed, but which never extended with pseudopod formation beyond the area exposed.

Exposure of a considerable area of skin was followed by an eosinophilia (8 per cent).

The subcutaneous injection of epinephrin (1 c.c.) did not prevent the reaction on exposure to light.

A reaction was followed by temporary exhaustion of the skin locally, so that further applications of light on the same day produced less or no reaction.

Application of light at daily intervals was associated with a considerable degree of local tolerance, so that, after repeated applications of light, a twenty-five minute exposure produced less effect on the skin than could be produced by a two-minute exposure of untreated areas. No marked increase in tolerance of the skin generally followed this treatment. (The word "tolerance" is used here in a very general way, for the apparent local tolerance may have been partly the result of an exhaustion process.) After a time this tolerance was lost, and telangiectases appeared over the treated area. In harmony with this, it may be mentioned that the face, neck, hands and forearms, which are, of course, naturally exposed to light at frequent intervals, were much more tolerant of light than covered areas, such as the chest, shoulders and back.

Every effort to produce hives by such agents as heat, rubbing, scratching, by the application of chloroform liniment, and by intracutaneous injections produced no visible effect unless the skin was simultaneously exposed to light.

During an experience over a number of years with the study of allergy, I have observed five patients who were excessively sensitive to the action of light. In three instances, a typical attack of nasal allergy with symptoms such as the swelling of the mucous membrane of the nose, sneezing, and profuse watery secretion, would invariably follow exposure of the retina to the action of sunlight. In other words, the reaction appeared whenever the patient looked at the sun or reflected sunlight. Such symptoms appeared also after the patient looked steadily for a few moments

at a thousand watt nitrogen lamp or a mercury vapor quartz light. The reaction was apparently caused more quickly by visible light than by the quartz light. In one case, the patient would react with formation of a typical wheal (characterized by erythema, edema of the skin, and itching) which would appear invariably after a two and one-half minute exposure of the skin to afternoon sunlight. The reaction would cover the entire area of skin exposed to light but would not extend beyond this area. When large areas of skin were accidentally exposed, as happened on three occasions, the patient reacted not only with localized urticaria but with symptoms resembling allergic shock—that is, shock resembling that which is caused by an overdose of pollen.

In the fifth case studied, the patient was apparently less sensitive. A one- or two-hour exposure of the skin was required to produce reaction, and when exposed the patient reacted slowly and less severely but the reaction lasted much longer—in fact, the rash, which would start one or two hours after exposure as a local urticarial rash, would, after several days, end up with a typical scaly eczema.

The reactions as above described were not different from those which have previously been described by the writer in which the reaction was caused specifically and solely by one of the following physical agents—heat, cold, mechanical irritation, freezing, and burns, and in the case of sensitiveness to heat, indirectly by the effect of physical or mental exertion. In the latter case, it is proven that the reaction was brought out indirectly through heat production and could be prevented by the simultaneous effect of cold.

Given the fact that certain rays of light can produce the reaction as above described, it would be interesting indeed to know the mechanism through which light in ordinary doses becomes violently toxic for the patient.

I may say at the outset that I have not sufficient data at hand upon which to base



a sound theory in explanation of the condition. I may, however, mention several possible explanations which may or may not be correct. They each seem to me, however, to be worthy of some consideration.

*First:* The patient who reacted with local urticaria came from a hay-fever, asthma, and hive family, and, without doubt, inherited the peculiar constitution which permits a patient to become hypersensitive to foreign agents. One wonders if the patients may not have become sensitive to some unusual substance formed in the tissues under the influence of certain rays of light, and, therefore, reacted to the substance elaborated by light in the same way that pollen-sensitive cases react to pollen when it is injected into the skin. If a large amount of pollen is injected subcutaneously into a pollen-sensitive patient, he reacts with symptoms of shock similar, in many respects, to the shock experienced by the light-sensitive case upon exposure of large areas of skin to light.

*Second:* It is well known that if hemato-porphyrin, eosin, quinine, and other photodynamic agents are injected subcutaneously into animals they become sensitive to light and react with local symptoms upon exposure to light and with general symptoms when large areas of skin are exposed. Animals fed upon buckwheat become light-sensitive and react similarly—in fact, this is recognized as a cause of death among white or spotted cattle.

It seems possible that in light-sensitive patients, some photodynamic substance is held in the tissues. The blood and serum of my patients were carefully examined for such bodies. None were found.

*Third:* It is well known that through the action of ultra-violet light, the temperature at which albumen coagulates and gelatin liquefies can be changed—in fact, proteins can be coagulated by the action of ultra-violet light if the hydrogen ion content of the solution is suitable and even by the action of visible light if a photodynamic substance, such as eosin, is added to the

solution. More interesting than this is the fact disclosed by Bovie and Klein, that exposure of *paramecium caudatum* to the action of ultra-violet light or radium ray makes them heat-sensitive, so that a rise in temperature of a few degrees in the media in which they live is quickly fatal—in fact, a rise in temperature from low to that which is most favorable for the life and reproduction of the animals causes death in a few seconds.

It does not seem beyond the realm of possibility that certain cells in the patient above described were affected in some such way as this, but instead of becoming sensitive to heat, became sensitive to the action of light.

*Fourth:* According to the experiments of Dr. Janet H. Clark, the various proteins of plasma, if separated from plasma and purified, can be coagulated by the action of actinic ray. Plasma itself, however, cannot be coagulated in this way. According to her view, the plasma may contain protective bodies which hinder light from coagulating body proteins. The existence of such substances would seem theoretically quite necessary for the protection of surface proteins, especially in animals that are frequently exposed to light.

It seems possible that the sensitiveness of my patients might be accounted for through a lack of such protective bodies. The serum of one patient, however, was studied carefully from this point of view, both by Dr. Clark and myself, and was found to behave like normal serum upon exposure to light.

#### SUMMARY

It can be easily seen from the above discourse that the question as to the fundamental cause of the reaction to light, just described, is still an open one. The fact that this extreme grade of light-sensitiveness exists, however, is without question, and that similar sensitiveness to the action

of roentgen ray or radium ray should exist seems to me to be quite probable.

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**Epithelial tumors of the thyroid.**—In relation to epithelial tumors of the thyroid, the greatest confusion and difference of opinion exist concerning the nature, the pathologic diagnosis, and the appropriate terminology. There has been a lack of sufficient discrimination between normal and adenomatous thyroid tissue. The importance of the rôle of pre-existing adenoma as the starting point for many epithelial malignancies has not been well appreciated. Insufficient account has been taken of the peculiarities of the thyroid as a special tissue or organ in determining the question of malignancy. Graham seeks to establish a more satisfactory conception regarding this whole subject. To begin with, in this conception of carcinoma, there are included all epithelial tumors with any clinical or pathologic evidence of malignancy. Any tumor that is or was an adenoma and has become malignant is classed as a malignant adenoma. Malignancy is deemed in evidence by local invasion, recurrence (of the original tumor) after incomplete excision, metastasis, or death of the patient owing to the invasive character of the tumor. On the basis of these definitions, the study of tumors arising from thyroid epithelium excludes the conditions known as paratracheal, struma post-branchialis, and squamous-cell epithelioma or carcinoma.

The material available at Lakeside Hospital from 1905 to 1922, inclusive, comprised 134 cases of thyroid tumor. Of 122 tumors examined pathologically, 108 were epithelial tumors, either malignant or suspicious, according to prevalent criteria. In conformity with data made available by Graham, however, these epithelial tumors are reclassified as scirrhous carcinoma (2), papilliferous adenocarcinoma (8), malignant adenoma (55), and benign adenoma (43).

Heretofore too much reliance has been placed upon the histologic character of the cells and tissue as an index of malignancy. The malignancy depends upon the capacity of the tumor to invade locally, cause local destruction, recur after operation, produce distant metastases, and finally to result in the death of the patient. The most constant single indication of thyroid epithelial malignancy is invasion of the blood vessels. Epithelial tumors in which there is invasion of the blood vessels cannot be regarded as entirely harmless, irrespective of their microscopic appearance. Encapsulated epithelial tumors without invasion of the blood vessels are benign, irrespective of their microscopic appearance. Scirrhous and papilliferous carcinomas are the only types of epithelial malignancy in which invasion of the blood vessels is not observed. The recognition of invasion of the blood vessels is not very difficult. Examination of the thyroid veins and the veins of the capsule and of the tumor immediately beneath the capsule will disclose gross thrombus and gross erosion which can be verified easily under the microscope. Four grades of invasion may be noted: (1) gross thrombus; (2) gross erosion; (3) microscopic evidence of tumor cells or tissue within the blood vessels, and (4) microscopic erosion of larger blood vessels, other than capillaries or sinuses. The character of the tissue within the blood vessels corresponds morphologically to some portion of the original tumor.

JOSEPH MUIR, M.D.

*Malignant Epithelial Tumors of the Thyroid, with Special Reference to Invasion of Blood Vessels. Allen Graham. Surg., Gynec. and Obst., Dec., 1924, p. 781.*

## THE TREATMENT OF TUBERCULOSIS OF THE FEMALE GENITALIA WITH LIGHT AND X-RAYS<sup>1</sup>

By HENRY SCHMITZ, A.M., M.D., LL.D., F.A.C.S., F.A.C.R., CHICAGO, ILL.

IN 1896 Finsen published his investigations on the therapeutic efficacy of carbon arc light treatment in skin, bone and joint tuberculosis and demonstrated the superiority of actinic therapy over the purely medical or surgical methods. Since then many reports have been issued sustaining the conclusions of Finsen. It was obvious that actinic therapy might, also, be a curative agent in tuberculous infections of other regions of the body, especially those of the genital organs of women. Clinical observations were carried on with various methods of light therapy. For instance, Rollier, Pestolozza and Myll use sunlight; Reyn employs the carbon arc light or artificial sunlight; Haussman and others use the ultra-violet rays produced by the mercury vapor quartz light, while Gauss, Bircher, Hoenicke and others apply the X-rays. It is interesting to note that Parker, an American, was the first to recommend the use of ultra-violet and X-rays in the treatment of abdominal tuberculosis.

Actinic therapy is gaining rapidly in importance in the treatment of surgical tuberculosis. A report of our observations made in the treatment of tuberculosis of the female genito-urinary organs with ultra-violet and X-rays was thought to be of practical value. The report comprises a few important clinical observations, the results obtained with medical, surgical and actinic or light ray treatment, the technic employed and the citation of the histories of cases to illustrate the therapeutic efficacy of light and X-rays.

### CLINICAL OBSERVATIONS

Genito-urinary tuberculosis of the female is a local manifestation of a generalized tuberculosis. It is almost always secondary to a primary infection in the respiratory or

digestive tracts. The route of infection may be hematogenous. Primary respiratory infections are thus transmitted to the genito-urinary organs. It may be descending, when the tubercle bacillus invades the genital organs through contact with the intestinal tract by adhesions and exudates, or lymphogenous by way of the lymph vessels. Ascending tuberculous infections are exceedingly rare; the primary focus is then located in the vulva, vagina or the vaginal surface of the cervix.

About 3 per cent of all female cadavers and about 10 per cent of all chronic tubal inflammations have genital tuberculosis. The uterine tubes are affected in about 65 per cent, and in about 50 per cent of tubal infections the uterus is also involved. The ovaries may become invaded in 10 to 15 per cent of pelvic tuberculosis.

Peterson found the frequency of tuberculous infections of the various regions of the genital tract in 100 cases of women subjected to operation to be as follows: The peritoneum was involved 60 times, the omentum 20, the uterus 30, the right tube 67, the left tube 61, the right ovary 30, the left ovary 25, the appendix 8, and the cervix 2 times. Ascites occurred in 23 cases.

Greenberg in a study of 200 cases of tuberculosis of the uterine tubes found the incidence of age to be as follows:

Up to 19 years, 25 cases, or 12.5 per cent.

From 20 to 29 years, 92 cases, or 46.0 per cent.

From 30 to 39 years, 55 cases, or 27.5 per cent.

From 40 to 49 years, 23 cases, or 11.5 per cent.

Above 50 years, 5 cases, or 2.5 per cent.

The respective percentages in Ochsner's report on tuberculous peritonitis are 34.4; 28.1; 18.8; 9.4 and 9.4 per cent.

<sup>1</sup>Read before the Radiological Society of North America, at Kansas City, December, 1924.

Therefore we may infer that tuberculous infections of the female genital organs usually occur during the menstrual life of women. The active congestion accompanying menstruation and sexual activity is probably a predisposing or contributing factor.

The history and clinical observations are of great value in diagnosis. The interrogation of the patient concerning a respiratory or intestinal infection must never be omitted. Hereditary tendency to tuberculosis is present in one-fourth of all such cases. Should physical examination elicit an active or dormant tuberculous focus in the lungs, then the inference of a secondary genito-urinary infection is correct in the majority of the cases. The bimanual palpatory findings rarely aid one in diagnosis. However, the persistence of an afternoon rise in temperature and a relative or absolute leukopenia point to the tuberculous nature of such pelvic findings. Greenberg observed pre-operative pyrexia in 63.5 per cent of his 200 cases. Cystoscopic examination of the bladder, the presence of tubercle bacilli in the urine, feces or sputum may aid in the diagnosis of the secondary genital infection. X-ray examinations of the chest also are important aids in the diagnosis.

#### METHODS OF TREATMENT

Every tuberculous infection, whether active or dormant, must be treated, as it constitutes an ever-existing danger to the entire organism. Treatment to be curative and permanent must be directed towards the disease and not towards a local manifestation of the disease. The methods of treatment are medical, surgical and actinic.

#### MEDICAL TREATMENT

It is generally admitted that about 50 per cent of cases of early tuberculosis are healed by medical means; if the genitalia are secondarily involved then the percentage of cures is reduced to about 33 per cent

(Mayer). A permanent cure of a tuberculous infection has been attained if the patient has remained well and free from recurrence for three years.

#### RESULTS OF SURGICAL TREATMENT

Surgical treatment according to the best authorities, also, gives a curability percentage of about 33. Peterson in 100 cases had an operative mortality of 7 per cent and 5 of these succumbed to general or military tuberculosis.

The secondary mortality was 9 per cent and of these 7 had positive chest findings at the time of operation. The absolute curability was 73 per cent. König obtained, in 131 cases treated surgically, 107 primary healings. However, 38 cases died during the first year and 17 cases during the second year. Therefore the healed cases at the end of the second year amounted to 39.5 per cent. Greenberg had a primary mortality of 17 per cent in a series of 200 cases of tuberculous salpingitis observed at the Johns Hopkins Hospital. Ninety patients were followed up: 12 died after discharge from the hospital and 9 of these from pulmonary tuberculosis. The frequency of tuberculous to other infections of the tubes was 1 in 13. Of 104 cases drained 17 had fecal fistulas, and of 96 cases not drained only 1 had a fecal fistula. There occurred also 5, or 2.5 per cent, urinary fistulas. The abdominal incision supplicated in 33.3 per cent. Braasch and Scholl report a series of 847 cases in which operation was done for unilateral renal tuberculosis. Of these, 119 died within five years after the operation and 77.4 per cent died from tuberculosis.

Surgery has many dangers on account of the primary mortality, the frequency of recurrences, the mutilating nature of the operation which should be a panhysterectomy, and the great number of fecal abdominal fistulas. Local surgical measures do not give end-results wholly satisfactory in genito-urinary tuberculosis.



## LIGHT RAY TREATMENT

N. P. Ernst published in 1922 the results of the treatment with carbon arc light baths of 502 cases of surgical tuberculosis of bones and joints. The results are shown in the following table. The cases are divided into uncomplicated and complicated, the complications being abscesses or sinuses.

	No.	Cured	Complete mobility	Partial mobility	Anky-losis	Im-proved	Not im-proved
Uncomplicated . . . . .	146	83%	88	18	5	5	19
Complicated . . . . .	362	91%	255	55	22	15	25

The results obtained with actinic therapy in surgical tuberculosis have been duplicated in the treatment of genital tuberculosis. The following table gives the results:

Name	Method	Cures	Improved	Died
Rollier . . . . .	Heliotherapy . . . . .	80%	8%	....
Lasser and Richter . . . . .	Ultra-violet rays . . . . .	71%	....	....
Bircher . . . . .	X-rays . . . . .			
Adhesive dry form (57 cases) . . . . .		52.6%	42.2%	5.3%
Exudative ascitic (45 cases) . . . . .		60%	37.8%	2.2%

The superior results obtained with light ray therapy in comparison with the medical and surgical method is quite obvious.

## TECHNIC OF ACTINIC TREATMENT

The technic of treatment which we employ in our clinic consists in the daily application of a light bath of an hour's duration from an Edison carbon light diffused by a reflector. The anterior and posterior body surfaces are each exposed for one-half hour. This is followed by the application of the ultra-violet ray obtained from an air-cooled quartz light, according to Rollier's method. The head is always covered. The body is divided into five parts. The table on page 286 shows the time duration and fields.

## CASE REPORTS

The results obtained may be illustrated with the following case reports:

Miss O'L., 19 years of age, was admitted to the Mercy Clinic March 10, 1922. She

had had an operation for genital tuberculosis six months previously without any subjective or objective improvement, but had three abdominal fecal fistulas. Her weight was 65 pounds. Treatment was applied according to the technic described. The fistulas healed promptly. The bimanual findings were normal within six months. To-day

she feels perfectly well and weighs 108 pounds.

Mrs. R., age 34 years, 0-para, was admitted April 16, 1922, with a diagnosis of

tuberculosis of the right kidney and descending infection of the bladder. Two years before admission she had a cholecystectomy for pain in the upper right abdomen, without relief. She had frequent attacks of hematuria, an incessant vesical tenesmus, and was bedfast. Tubercle bacilli were repeatedly found in the urine. Light ray treatment was begun, but improvement was very slow. An exacerbation occurred in June, 1922, and the right kidney was explored. It was large and fluctuating. Nephrectomy was done. Improvement under actinic ray treatment was now rapid. At the last examination, December 8, 1924, she had gained 100 pounds in weight. The capacity of the bladder was 120 c.c. and cystoscopic examination revealed a complete healing of the extensive ulcers of the bladder mucosa.

		PARTS				
Day		1	2	3	4	5
1	Anterior .....	1 min.				
	Posterior .....	1 min.				
2	Anterior .....	2 min.	1 min.			
	Posterior .....	2 min.	1 min.			
3	Anterior .....	3 min.	2 min.	1 min.		
	Posterior .....	3 min.	2 min.	1 min.		
4	Anterior .....	4 min.	3 min.	2 min.	1 min.	
	Posterior .....	4 min.	3 min.	2 min.	1 min.	
5	Anterior .....	5 min.	4 min.	3 min.	2 min.	1 min.
	Posterior .....	5 min.	4 min.	3 min.	2 min.	1 min.
6	Anterior .....	6 min.	5 min.	4 min.	3 min.	2 min.
	Posterior .....	6 min.	5 min.	4 min.	3 min.	2 min.
7	Anterior .....	7 min.	6 min.	5 min.	4 min.	3 min.
	Posterior .....	7 min.	6 min.	5 min.	4 min.	3 min.
8	Anterior .....	8 min.	7 min.	6 min.	5 min.	4 min.
	Posterior .....	8 min.	7 min.	6 min.	5 min.	4 min.
9	Anterior .....	9 min.	8 min.	7 min.	6 min.	5 min.
	Posterior .....	9 min.	8 min.	7 min.	6 min.	5 min.
10	Anterior .....	10 min.	9 min.	8 min.	7 min.	6 min.
	Posterior .....	10 min.	9 min.	8 min.	7 min.	6 min.

and so on until exposures of 15 minutes are used daily over anterior and posterior surfaces. With this method erythema is never seen, but a pronounced tanning of the skin is produced. The treatment is given every other day as soon as the local findings begin to improve and twice a week for an entire year when local healing has been attained. If a rise in temperature should occur, then we must interrupt the treatment until the patient has been afebrile for ten to fourteen days. If the tuberculous exudate or infiltrate does not begin to decrease within four to six weeks, we add X-ray therapy to the ultra-violet ray treatment. The X-rays are applied locally. They must be hard and filtered to produce a homogeneous penetration of the entire disease area. The dose must be small and should be from 10 to 5 per cent of a full skin dose attained at the depth of the disease. The 5 per cent E. S. D. may be repeated every three weeks and the 10 per cent E. S. D. every six weeks until resolution of the tuberculous process is complete, which occurs ordinarily within four to six

months. If after the second X-ray treatment the general and local condition has not markedly improved, then we may consider the case refractory to actinic therapy. The X-rays also may cause a temporary amenorrhea which is desirable.

Actinic therapy does not interfere with surgical procedures that might be indicated, as the evacuation of abscesses or the removal of ascitic fluid through a celiotomy. The ascitic fluid should always be removed if it has been present longer than four weeks.

We, also, must not neglect the general management, as absolute rest in bed, open air, sunshine, wholesome, nourishing food and medication.

#### CONCLUSIONS

The curative results of medical, surgical and actinic treatment of surgical tuberculosis have been discussed and the superiority of light ray treatment demonstrated. Equally good results have been obtained

from the actinic treatment of tuberculous infections of the female genito-urinary tract.

The technic of the application of ultra-violet and X-rays has been described. The

treatment does not interfere with surgical measures that might be indicated and medical treatment also must not be neglected.

The efficacy of actinic therapy has been illustrated by two case reports.

**Radium in gynecologic practice.**—The author has been using radium for nine years, and considers that it is indicated in the following conditions:

Primary and recurrent malignant tumors of uterus; benign tumors of the uterus (in these two conditions it finds its greatest field). It is also used in menorrhagias and metrorrhagias (without known cause, or those due to cystic oöphoritis), menopausal hemorrhage, endocervicitis (with leucorrhea), dysmenorrhea, malignant disease of vulva and vagina, benign and malignant disease of the bladder, malignant disease of the rectum, vulval leukoplakia and vulval and anal pruritus, localized recurrent malignant nodules following amputation of breast.

In uterine cancer, the author is not yet ready to forsake surgery in the early cases, but holds an open mind on this subject. He employs pre-operative radiation in all cases, using 2,400 mg.h., four weeks before operation. His personal experience in the use of radium alone has been limited to the inoperable cases, of whom 112 have been treated, but only two have lived beyond the five-year period, although every patient was benefited locally and systemically, so that as a palliative agent, there is nothing to compare with it.

In uterine myomata the author agrees with Béchère that "the treatment of uterine fibromata is quite legitimately passing from the hands of the surgeon to the medical radiologists and from year to year it will thus pass in increasing proportions." In the author's cases, the dose ranged

from 1,200 to 2,400 mg.h., and in all but four of 77 patients a single dose was sufficient. Correct diagnosis is very important.

In menorrhagia due to fibroids, between the ages of thirty and forty, myomectomy is given first place and radiation second place. It is unusual for women to conceive and continue to term after radiation. Mathews has reported 874 patients radiated in the childbearing period, of whom 39 conceived and 20 went to normal delivery. But if a permanent amenorrhea is to be avoided, the dosage must be small. The indications for radium in myomata are given as follows: Small growths at any age, with certain reservations, if associated with bleeding; in all types of myomata, except the submucous, if not complicated by infection; in obese women; where operation is refused; where surgical risk is great; in tumors not over the size of four months' pregnancy and not rapidly growing; where malignancy, calcification and infection are not present.

In intractable uterine bleeding in young women, radium has a field, but certain dangers. For abnormal bleeding at the menopause, radium is the pre-eminent remedy. In endocervicitis, 50 mg. in the cervical canal for twelve to sixteen hours is recommended by Curtiss. The other conditions mentioned in the outset are briefly discussed.

W. W. WATKINS, M.D.

*Radium Therapy in Gynecology.* P. Brooke Bland. *Med. Jour. and Rec.*, Aug. 6, 1924, p. 101; Aug. 20, 1924, p. 156.

## LIGHT TREATMENT IN MEDICINE<sup>1</sup>

By AXEL REYN, M.D., Head Physician of Finsens medicinske Lysinstitut, COPENHAGEN, DENMARK

**F**IRST, I should like to tender my thanks to you for having invited me to speak before this meeting of clever and excellent colleagues. I deeply appreciate the honor shown me.

As one of Finsen's successors I have decided to speak on light treatment.

You know that if the white sunlight is falling through a prism, it is refracted in a series of different colored rays, red, orange, yellow, green, blue and violet rays, the so-called spectral rays. Besides these visible rays, there are in the spectrum some invisible ones, *viz.*, the ultra-violet outside the violet and the ultra-red outside the red ones. The different rays in the spectrum have different qualities: the red are heating; the yellow, orange and green ones are luminous; the blue, violet and especially the ultra-violet ones have a chemical effect, that is to say, they have the power of splitting chemical compounds and have certain biological effects on the living organism. Finsen examined these biological powers, basing modern light therapy on them.

Time does not allow me to mention Finsen's different investigations on which he based light treatment, and, indeed, greatly helped the rapid development of all radiotherapy. I must restrict myself to mention that after a lengthy series of investigations Finsen proposed to utilize light, concentrated through lenses for local treatment, and non-concentrated for exposing the whole body to light baths. These two forms of treatment are entirely different, not merely in their principles but also in their mode of action. In the local treatment with concentrated chemical light, one is treating a very small portion of the part of tissue that is affected, with an extremely powerful chemical light. The treatment is based on the light's qualities of being able to destroy the bacteria and of producing inflammation in the skin, which qualities we utilize to bring about the direct destruction of all af-

ected parts of the tissue. The light bath, on the contrary, is a universal irradiance; thus in irradiating the whole body by chemical rays, we endeavor to play upon the whole organism and to cure different diseases. No stress is laid on irradiating the affected parts, but great weight is laid on giving the surface of the human body as much light as possible.

### LOCAL TREATMENT

At the beginning of his experiments Finsen used the sun as a source of light; but it was clear to him that if light treatment was to be of any great value at all in northern countries, where there is a lack of sunshine, it would be necessary to make use of artificial light. He chose as an artificial light source carbon arc light, as being, among the whole class of artificial lights, that which, in its properties and composition, comes nearest to the light of the sun, having almost a continuous spectrum.

In further experiments Finsen showed that the ultra-violet rays have the strongest effect, and consequently he gradually employed only artificial light, for carbon arc light contains far more ultra-violet rays than the sun, the ultra-violet rays of which are absorbed by the atmosphere. The installation used for local treatment with concentrated chemical light is composed of a 50 ampere carbon arc light lamp; hanging around the lamp there are four apparatuses with four convergent lenses for concentrating the light; these lenses are made of rock-crystal, which, unlike ordinary glass, does not absorb the ultra-violet rays. Along with the chemical rays the heating rays also are, of course, concentrated. For absorption of these a layer of distilled water is placed between some of the lenses.

Chemical rays have the power of penetrating the body, but as soon as the rays get at the tissues filled with blood, all chemical light will be absorbed by the blood;

<sup>1</sup> Paper read before the Radiological Society of North America, at Kansas City, Mo., December, 1924.



consequently if you want the light to have any effect in the deeper parts of the body the skin must be made bloodless. Finsen, therefore, constructed a compressing apparatus, by means of which he pressed

larly short wave ultra-violet rays, with but slight power of penetrating. If one, therefore, desires an effect of light in the deeper layer of the tissue, the mercury vapor light is not adaptable in therapy; the employ-



Fig. 1. See Figure 2.



Fig. 2. Patient 30 years of age. Lupus vulgaris of 15 years' duration. Local light treatment, 1898, 131 séances (5 months). Cured since 1898. (See Figure 1.)

away the blood from the spot to be irradiated. The lenses in the compressor are made of rock-crystal.

By this installation four patients can undergo treatment simultaneously; furthermore, we have constructed an apparatus for treating a single patient (the Finsen-Reyn apparatus). The principles are quite the same as in the larger installation.

The Finsen light installation for local treatment with concentrated chemical light being somewhat expensive and complicated, other apparatuses have been constructed to take the place of the Finsen one; but these apparatuses are of no value, with the exception of the "Kromayer Quartzlampe," which in a few cases may be employed. The light arc in that lamp is formed between two poles of mercury, and the glowing mercury vapor radiates the light.

The difference between carbon arc and mercury vapor light is, in reality, very considerable. Carbon arc light contains all rays of the spectrum, while mercury light mainly contains ultra-violet, and particu-

ment of the Kromayer lamp in medical treatment is therefore limited. The circumstances under which this lamp should be made use of will be mentioned later on.

#### *What diseases can be treated with concentrated chemical light?*

Finsen chose lupus vulgaris for testing his method, for this disease is situated in the skin itself and is brought about by bacteria (the tubercle bacillus). This disease was really, in a large number of cases, incurable, and those patients who were cured, remained disfigured for life by ugly scars. The majority of these patients are now cured by Finsen's local light treatment, leaving smooth and almost imperceptible marks behind.

A vast collection of material gathered in our experience shows that over 60 per cent of cases were cured. Dr. Sequeira, of the London Hospital, one of the first to make use of the treatment, has had 70 per cent of permanent cures; he is of the opinion

that we have had under treatment a graver type of lupus than he has had in the London Hospital. The results of the treatment of tuberculosis verrucosa, tuberculosis col-

my remarks about the difference between the carbon arc lamp and the mercury vapor lamp, is much inferior to Finsen's, and I consider it to be a very serious fault to make



Fig. 3. See Figure 4.

liquativa and tuberculosis conjunctiva have been even more excellent (90 to 100 per cent cured). In different forms of surgical tuberculosis and tuberculous glands with sinuses we also often utilize local treatment simultaneously with light baths, but light baths are the principal treatment in these cases.

Local application of concentrated light in the treatment of lupus vulgaris was an entirely new therapeutic principle. The aim before one being to attack from outside the diseased tissue without injuring at all the healthy tissue, experiments show that concentrated light produces a proliferation of the healthy tissue, bringing about a new formation of vessels, and at the same time destroying diseased cells. But it is necessary to get a relatively deep effect, because the diseased cells of lupus vulgaris are placed in the skin itself. According to this you will understand that we always have to use the most penetrating light, and therefore the Kromayer lamp, if you noted



Fig. 4. Patient 23 years of age. Lupus vulgaris of 7 years' duration. Local light treatment, 1899, 90 séances (3 months). Cured since 1899. (See Figure 3.)

use of the Kromayer lamp in treating the above-mentioned forms of tuberculosis.

Local treatment with concentrated carbon arc light (Finsen treatment) can also be utilized in some other cases of skin diseases, but it has its greatest value in lupus vulgaris and other kinds of skin tuberculosis.

*Lupus erythematosus.* In this disease we now very seldom make use of local light treatment, because the freezing with carbonic acid snow and the treatment with Thorium X give far better results, but in some cases, when we have no effect from these two treatments, we may employ the Finsen treatment and get excellent results. The Kromayer lamp gives inferior results here.

*Acne vulgaris et rosacea.* In some cases, not to be cured by ordinary treatment with ointment, one may try concentrated carbon arc light or the Kromayer lamp.



Fig. 5. See Figure 6.

**Alopecia-areata.** In this disease one obtains favorable results with the Kromayer lamp or Finsen light, but it is very important to begin treatment before the spots are too extended.



Fig. 6. Patient 32 years of age. Lupus vulgaris of 8 years' duration. Local light treatment and light baths during 10 months in 1918 and 1919, and 3 months in 1920. Cured since 1920. (See Figure 5.)

**Röntgen ulcer.** Concentrated carbon arc light has a very good effect, when the ulcers are not too extended and too deep; they heal very well under cautious and careful treatment. One has to use only a very short séance (5 minutes) and to begin at the edge of the ulcer. *The mercury vapor lamp should not be used here, for the very short wave ultra-violet rays have a bad influence on the ulcers.*

**Other kinds of skin diseases.** During the last few years we have tried concentrated carbon arc light in cases of chronic eczema with most excellent results (Lomholt, *Brit. Jour. Dermatol. and Syph.*, XXXV).

**Xanthelasma.** In cases of xanthelasma of the eyelids we have had excellent results. The tumors disappear entirely without leaving any scars or marks behind.

**Trachoma.** Dr. Lundsgaard has made use of concentrated carbon arc light at our Institute in cases of trachoma and the treatment has given excellent results, particularly in fresh cases.

#### LIGHT BATHS

I have already told you that Finsen proposed utilizing the sun or artificial light to irradiate the whole body. He had shown that erythema of the skin, produced by chemical light, remains months after the last irradiation, and he had shown that chemical light has a stimulating effect on the organism as a whole. He was of the opinion that these two important qualities of light could be utilized in curing a series of diseases, amongst others, heart disease and tuberculosis.

He died before being able to complete his labors on light bath treatment, unfortunately, and it was left to others to carry out the experiments first laid down by him.

Dr. Hasselbalck, Finsen's successor at our laboratory, was the first to create a light bath therapy, based on experimental work. He pointed out that skin erythema, to the importance of which Finsen had called attention, brought about a fall of the blood pressure in the blood vessels in the periphery, and caused deeper respiration.

On these two effects of the light Dr. Hasselbalck based the light bath treatment of heart disease, and Rubow found the same two effects on patients. The light bath can, in

window panes is of no value, on account of the glass absorbing the chemical rays which escape atmospheric absorption. If light treatment is to be of any benefit at all



Fig. 7. See Figure 8.



Fig. 8. Patient 32 years of age. Lupus vulgaris of 1 year's duration. Local light treatment and light baths in 1919 and 1920 (about 6 months). Cured since 1920. (See Figure 7.)

different forms of heart disease, relieve the dyspnea.

In Switzerland, Bernhard, and somewhat later, Rollier, and in England, Sir Henry Gauvain, were the first to use the sun bath for surgical tuberculosis.

Having seen the excellent results that Rollier obtained I decided to try light baths in treating lupus vulgaris and various forms of surgical tuberculosis. But we are at a natural disadvantage in regard to sun baths in the northern lowlands, because the chemical power of the sunlight is only minimal, owing to atmospheric absorption; furthermore, bright sunny days are few and far between. Heliotherapy, therefore, can be used only in the summer months and at the seaside, where the value of the sun is enhanced by the reflection of light from the mirror surface of the sea. In winter there is next to no chemical power in the sunlight, and the weather is too bleak to allow patients to be out of doors in a naked state, and to use sun baths in closed rooms behind

in northern countries, artificial light must take the place of sunlight.

The results obtained at the Finsen Institute in Copenhagen have shown that this is feasible. From the beginning we used only carbon arc light, simply because this light has a spectrum almost like the spectrum of sunlight. The carbon arc light lamps that we are using, both in local light treatment and in light baths, burn with direct current, for the light we utilize comes from the crater on the positive carbon, and if one were to use alternating current no crater would be formed.

At the Finsen Institute, for light baths we use lamps burning with 75 amperes, or 20 amperes and 50-52 volts. This tension is the most favorable in the lamp, for by this voltage most chemical light is obtained, as was proved conclusively by Finsen. The voltage necessary in the conducted current is 70 volts, for the lamp will burn only



quietly and steadily if there is a small surplus in the current; this surplus has to be absorbed by a resistance. The carbons are perpendicular, and the focus has to be

is unable to burn as it should. The following dimensions are the thinnest to be used.

For a 75 ampere lamp, the upper carbon must be 31 mm. and the lower 22 mm. in



Fig. 9. See Figure 10.

fixed. The dimensions of the carbons are also of greatest importance and a point by no means to be overlooked, for, as I just stated, it is the crater light that we utilize. The more white glowing the crater is, the more chemical light radiates from the crater; therefore, it is of extreme importance to employ as thin carbons as possible, which means to send as strong current through the carbons as they can stand. In this way one will bring about a very white glowing of the crater and consequently much chemical light. How much current the carbons can stand is, however, limited, for if the amperage is too high, the whole carbon will be glowing and then the lamp



Fig. 10. Patient 9 years of age. Dactylitis of several of his fingers of 4 years' duration. Treated without interruption for two and a half years at a seaside hospital, without cure. Light baths and local light treatment 1915-1916 (8 months). Cured, with complete free mobility. (See Figure 9.)

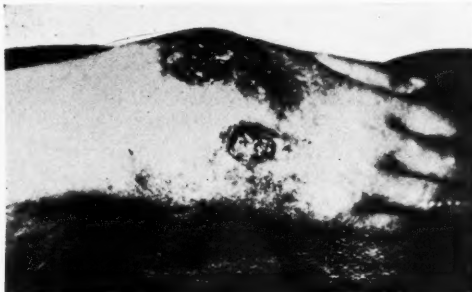


Fig. 11. See Figure 12.

diameter; for a 50 ampere lamp 24 mm. and 17 mm., and for a 20 ampere lamp 12 mm. and 8 mm. in diameter. Special lamps should therefore be constructed for both local treatment with concentrated light and for light baths, and ordinary kinds of carbon arc light lamps should not be used, for good results will not then be obtained. In the Finsen Institute we have constructed such lamps. The lamp must never be enclosed in an envelope of any kind of glass,



Fig. 12. Patient 16 years of age. Tuberculous arthritis with sinuses of right wrist of 1 year's duration. Treated at a hospital with operations and put in splints. On entering the Finsen Institute patient was unable to move his hand. Light baths for 10 months. Cured since 1919, with partial, almost free, mobility. (See Figure 11.)

as I have seen in some places, for this will simply absorb chemical light.

If we want to treat more patients at one time, we use two 75 ampere lamps hanging

quently one can get much nearer the 20 ampere lamps than the 75 ampere ones.

The intensity of light decreases with the square of the distance. If the patient,



Fig. 13. See Figures 14 and 15.



Fig. 14. See Figure 15.



Fig. 15. Tuberculous arthritis with sinuses of left knee of 7 years' duration. Operated on several times before entering the Finsen Institute. Light baths 1917-1918 (1 year). Cured, with complete, free mobility.

side by side; the space between the lamps is 0.6 meter, measured between the carbons, and the crater on the positive carbon is 1 meter from the ground. The patients sit round the lamps. Should we have to treat a patient who cannot support a sitting posture, we make use of three 20 ampere lamps hanging side by side; the space between the lamps is 0.55 meter, measured between the carbons; the crater on the positive carbon is 30 to 35 cm. over the couch of the patient.

The 75 ampere lamps, of course, radiate much more chemical light than the 20 ampere lamps; but at the same time the heat rays are increased considerably and conse-

therefore, is 1 meter from the light crater, he gets only a quarter of the light that he gets if the distance is 0.5 meter. You will understand, after my remarks about the heat rays, that we can adjust the difference in the light intensity between the two installations by placing the patient nearer the light itself.

Around the 75 ampere lamps from six to eight patients can sit at one time, and by employing the 20 ampere lamps we can treat two patients in a reclining position simultaneously. If one wishes to have patients in a reclining posture treated by the big lamps, one can have only two patients, for if a greater number are to be treated collectively one patient will merely shade the other. Thus it is more econom-

ical to apply the 75 ampere lamps if one has many patients who are able to assume a sitting posture, and the 20 ampere lamps if one is treating patients who have to be in a reclining position.

As soon as the great value of carbon arc light bath treatment was proved, there were constructed naturally, as in the case of the local light treatment, cheaper lamps for artificial chemical light baths, to take the place of carbon arc lamps. Only the mercury vapor arc lamp is of any value; all others contain so little chemical light that they are hardly worth mentioning. The difference between the carbon arc light and mercury vapor light has been mentioned already and this difference is decisive for the use of the two light sources for artificial light baths, but I shall later on refer to this question.

*What diseases are to be treated by light baths?*

Besides the complaints already mentioned, *viz.*, heart disease and tuberculosis, we are treating some other diseases with light baths at the Finsen Institute. But it must be said that light has its greatest value in treating different forms of tuberculosis, and therefore I will take up the light bath treatment of tuberculosis first.

LUPUS AND OTHER FORMS OF SKIN TUBERCULOSIS

I have touched upon the enormous value of the local application of concentrated light in the treatment of lupus vulgaris, but we have long recognized that a certain number of cases are refractory to the treatment, and in other cases the disease has a tendency to increase too rapidly to be dealt with adequately by this local treatment, or, if apparently cured, is likely to relapse. Finally, some cases are so advanced before treatment that they already have a bad prognosis.

In these cases I decided, first, to try carbon arc light baths and the results were

better than I expected. I succeeded in curing 96 patients out of 114 by the combination of local light treatment and light baths, cases which had failed to be cured by the local application of concentrated light, notwithstanding that they had been treated very energetically. On examining the figures now, where all patients under treatment for lupus vulgaris are undergoing local light treatment and light baths simultaneously, I find that the proportion of permanent cures is about 90 per cent. The enormous value of light baths in the treatment of lupus vulgaris is evident from the fact that not only are the results getting much better, but also the time devoted to curing patients is getting much less.

One might ask whether light baths alone are not able to cure the patients; but I can assure you that however invaluable light baths are in the treatment of lupus vulgaris, so indispensable also is the local treatment. No doubt a single little spot can be caused to disappear by the light bath, but it is very rare. The disease can be improved by light baths alone, but a real cure will not take place without local application of concentrated light.

SURGICAL TUBERCULOSIS

Simultaneously with the light bath treatment of lupus vulgaris, I have also tried the effect of carbon arc light on different kinds of surgical tuberculosis, and I have asked the consulting surgeon in our Institute, Dr. N. P. Ernst, to examine and to control these patients.

During a period of eight years (1913-1921) we have treated no fewer than 439 patients by carbon arc light baths—145 with uncomplicated closed cases of surgical tuberculosis and 294 complicated with sinuses or abscesses. The results have been most excellent, as stated in print by Dr. Ernst in his latest report in *Acta radiologica*, Vol. I, p. 422. In his report you will find that 77 per cent of cases treated for uncomplicated closed cases of tuberculosis in the bones and joints, and 83 per cent of cases complicated with sinuses or abscesses,

were cured. These are brilliant results, if you remember that among our patients there was a vast number with severe affections of pelvic osteitis, hip disease, and spinal caries, operated on several times



Fig. 16. See Figures 17, 18, and 19.

without results. Also it has to be remembered that our patients are mainly adults (70 per cent were more than fifteen years of age), and you are well aware that tuberculosis in adults is much more difficult to cure than in children.

The results obtained from carbon arc light baths in the treatment of surgical tuberculosis are most astonishing. To give an idea of the great value of the results obtained by us I should like to make a comparison with the results obtained by Rollier, calling to mind, however, that he is working under much more favorable conditions, with his patients inside his hospital, while a large number of our patients, owing to lack of space in the Institute, have had to be treated as outdoor patients, and during the light treatment they have lived in their own homes, often very poor and un-

sanitary. Daily, or every other day, they have had to be transported to the Institute, and you will very well understand that this moving about has not benefited them.

If we take the figures from Rollier's "La cure de soleil" we find: Ankle joints—of 94 cases, complicated and non-complicated, Rollier registers 87 (92 per cent) as cured, but under tuberculosis of the ankle joint he includes cases of osteitis in the calcaneus, tarsus and metatarsus, which have a far more favorable prognosis than those which Dr. Ernst includes, namely, tuberculosis around the astragalus. Of the 47 cases which Ernst includes under ankle-joint tuberculosis, we have cured 42 (89 per cent), and 36 of these cured patients have regained complete mobility of their limbs. The proportion of cures by Rollier of tuberculosis of the elbow is 93 per cent, 66 per cent with free mobility, 27 per cent without mobility. We have also to record 93 per cent of cures, but 83 per cent have regained free mobility.

The results we have had in treating different forms of surgical tuberculosis are at least as good as those obtained by heliotherapy in mountain heights. I shall refer later on to the conclusions to be derived from this fact, but here I would like to request your attention to the conclusions arrived at by Dr. Ernst in his last report:

"If, in conclusion, I attempt to state which cases of surgical tuberculosis adapt themselves best to light bath treatment, this will be most easily done by recapitulating the cases which have proved refractory. These are the uncomplicated tenosynovitis cases, and the very old fistulous bone affections in the spinal column, pelvis, and hip, while the latter cases (of about twelve months' standing) are not particularly unfavorable to treatment." (All the cases of tuberculosis in the bones or joints are naturally controlled by means of roentgenography.)

"As regards the knee, I have become more conservative in my treatment of adults with whom a fixed condition of flexion has



already set in or where there are very severe capsular changes. In many of these cases it will end in resection.

"Slight tuberculosis of the lungs is no contra-indication for light bath treatment, but one must, of course, consider the general state of health, especially the condition of the lungs, heart and kidneys."

The time spent in curing a patient naturally differs according to the nature and locality of the affection. Broadly speaking, one can say that children are cured more rapidly than adults, and affections of the small joints are more quickly and easily healed than those in the large joints. Very excellent results and quick recovery are obtained in tuberculosis of the soft tissues and bones. The shortest time we have needed for a cure was one month, but often the cure has taken six months, and in some cases even two years and longer; but to a doctor accustomed to treating tuberculosis this is quite natural.

As a separate group, I wish to mention tuberculous glands. In the early years, owing to lack of space, I treated only a very few cases, but later on the number of patients treated by radiotherapy increased more and more. You are well aware that X-rays are applied to a considerable extent in the treatment of tuberculous glands; medical authorities find that hyperplastic forms give the best results, while the glands with sinuses give less favorable end-results. For some time I treated the glands entirely with X-rays, and only in very serious cases, with formation of sinuses, did I employ light baths. However, as soon as accommodation permitted it, I utilized light in addition to X-rays, for I found that the results obtained by X-rays alone were less satisfactory. Furthermore I remarked that X-ray treatment brought about a great risk for the patients, because the roentgen rays, even if they are filtered through metal, very often, after a few irradiations, cause a considerable atrophy of the skin, with disfiguring telangiectasia, and sometimes ulcers most difficult to heal are formed.

The results I have obtained by the combination of carbon arc light baths and X-rays and by light baths alone have been excellent, not only in cases of hyperplastic glands, but also in sinus cases. About 95



Fig. 17. See Figures 16, 18, and 19.

per cent of 500 cases have been cured, among which were many severe cases of several years' duration. The results illustrate to an eminent degree the great value of carbon arc light baths in the fight against tuberculosis.

#### RHINO-LARYNGOLOGICAL TUBERCULOSIS

After I had proved the enormous value of carbon arc light both in lupus vulgaris and surgical tuberculosis, our otologist, Dr. Strandberg, tried the light baths in treating tuberculosis of the ears, mucous membrane of nose, mouth, pharynx and throat, and he found that light bath treatment was of great value in these diseases.

## PULMONARY TUBERCULOSIS

While the excellent effect of light baths in curing all the mentioned forms of tuberculosis is incontestable, the value of light baths in pulmonary tuberculosis is a matter



Fig. 18. See Figures 16, 17, and 19.

open for discussion. Only on one point do writers agree, *viz.*, that light baths have to be employed in almost all non-feverish cases for their stimulating influence on the organism. Depressed individuals and such patients as have no appetite and are slack, show a vast improvement in body and spirits, gaining in weight under light bath treatment, circumstances which are of enormous value in curing this disease.

*Attention has also to be drawn to the point that one should make use of light baths for individuals who are suspected of suffering from tuberculosis.* I have tried the light in many of these cases with the result that the patients have become well and healthy.

Besides tuberculosis, light baths can be employed for other complaints; however, tuberculosis is the principal field. Before

leaving the discussion of these diseases I should like to draw your attention to different points which are of greatest importance for the employment of light baths in tuberculosis.

*What conclusion can be drawn from the results obtained by treatment with artificial chemical light baths at the Finsen Institute?*

First, we learn from the results by Rollier and at the Finsen Institute that non-operative treatment ought to be used in cases of surgical tuberculosis, not only in children, but also in adults. We learn that the most important factor in the conservative treatment of surgical tuberculosis in the mountains is the powerful light to be had there, for we have had just as good results at the Finsen Institute with artificial light as have been attained at mountain hospitals, despite the fact that many of our patients have been living under very poor hygienic conditions.

What I have said on this point is not to be understood in the sense that we should not obtain better results if we made use of all factors which we have in the mountains or at the seaside—namely, the crisp air devoid of mist, the benefit of sea baths, etc. Particular stress must, however, be laid on light, and in the sanatoria at the seaside and in the mountains there should be artificial sources of light for light baths to be used when the sun cannot be utilized, for then the results would be much better and the time spent on the treatment of less duration.

Conservative treatment of surgical tuberculosis is not to be understood as meaning that operative treatment must never be employed—that is not the correct definition, for it happens very often that abscesses have to be aspirated and sequestra have to be removed. The correction of ankylosis or other deformities is indispensable, and if a case does not improve it may be necessary perhaps to extirpate the tuberculous lesion.

*How are we to explain the effect of light on tuberculosis?*

I regret to say we have not advanced any further in our knowledge of this question than had Finsen in his day. Light gives an erythema of the skin, followed and accompanied by pigmentation, and light has a stimulating effect on the organism in general. The results are obtained only clinically, and conclusions must be drawn by clinical results alone. Not that explanations and experiments are wanting, but these are merely hypotheses. I shall therefore not touch on this point, but try to find out what is to be learned by clinical experience.

I desire only to say a few words about the rôle of the pigment. Rollier and other medical authorities lay stress on and point out that if the skin of a patient suffering from surgical tuberculosis is easily and quickly pigmented, then the prognosis should be better than if the patient does not form pigment well. I do not at all agree with this opinion, for at the Finsen Institute we see patients without or with very little power of building pigment cured almost as well as patients with strong power of forming pigment.

In the treatment by heliotherapy of cases of surgical tuberculosis we obtain by far the best results in the mountains or at the seaside, while the results in low-lying inland regions are less favorable. From this fact we must conclude that the chemical power in the sunlight is of greatest importance to the treatment, for the atmosphere absorbs the chemical rays, and the more compact the atmosphere, the greater the absorption. The chemical power of the sun is, therefore, much less in lowland districts than in mountain heights; at the seaside the lesser intensity is compensated for by reflection of light from the mirror surface of the sea, by which the intensity of light is increased enormously. This shows us that for beneficial effects the chemical power of light is decisive.

*What kind of chemical rays are in question?*

On this point we know but very little. We are aware, however, that the atmosphere especially absorbs the ultra-violet rays; these therefore must be the most important,



Fig. 19. Patient 17 years of age. Tuberculous glands with sinuses of 4 years' duration. Treated at a seaside hospital, without results. Light baths and local light treatment 1916-1917 (9 months). Light baths, 160; séances, 230. Cured.

and especially the ultra-violet rays with long waves, for the thinnest layer of the atmosphere absorbs all rays with short waves. A series of investigations (Jansen, Maar, Hasselbalck) shows us that greatest importance must be placed on ultra-violet long wave rays; these alone have the power of penetrating the epidermis. The violet, blue and green rays are also of a certain value, as Finsen's experiments have shown; and recently Sonne has claimed that not only these rays, but also the green, yellow and luminous red rays are of some impor-



Fig. 20. See Figures 21, 22, and 23.

tance, according to experiments made by him in the Finsen Institute.

*What kind of illumination is to be preferred?*

Naturally the sun is the best and the most economical source of light, when it can be used. As already mentioned, the atmosphere absorbs a great deal of the chemical light of the sun; the absorption increases in proportion to the thickness of the atmosphere—in other words, it is greatest in lowland countries. Furthermore, the less perpendicular the rays are, the greater is the absorption from the atmosphere, because the length of the rays, passing through the lower and more concentrated regions of the atmosphere, increases as the rays fall less and less perpendicularly. The chemical force of the sun is, therefore, considerably greater in mountains than in the lowlands, though I must emphasize once again that at the seaside the light intensity is increased very considerably by the reflection of the



Fig. 21. See Figures 20, 22, and 23.

mirror surface of the sea. In the mountains the sun can be used during the greater part of the year, but in the lowlands only when the light is falling rather perpendicularly—in northern Europe, for example, only in summer, and, of course, in bright and clear weather. In the mountains as well as in the lowlands artificial illumination should be employed during the absence of sunlight.

*What kind of artificial light sources are to be used?*

Practically we have only two sources that contain a quantity of chemical light worth mentioning—namely, carbon arc light and mercury vapor arc light. The difference between these two kinds of lights is, as mentioned, very considerable, and referring to my previous remarks on this subject it is evident that carbon arc light is without doubt more suitable for light baths than mercury light, and furthermore in a series of experiments undertaken at the Institute I have proved that far better results are obtained with carbon arc lights than with mer-





Fig. 22. See Figures 20, 21, and 23.

cury light baths. In Germany mercury light has been used most, and lamps have been constructed called "Kunstliche Hohen-sonne"—a name that is, in reality, quite misleading, as the "high sun" contains all kinds of rays, while the spectrum of mercury light is strongly limited, and has the maximum in ultra-violet rays, especially those with short waves. Naturally mercury light has some effect, and if carbon arc light, on account of deficiency of current, cannot be employed, mercury lamps, especially the new Jesionek lamps, are of some value; but we must not expect to obtain approximately such favorable results as with carbon arc light.

Because of the one-sidedness of mercury light, an attempt has been made to supply the qualities of the missing rays by using strong incandescent lamps constructed with metal wire for irradiating simultaneously with mercury light; but it has not been possible to create a source of light propor-

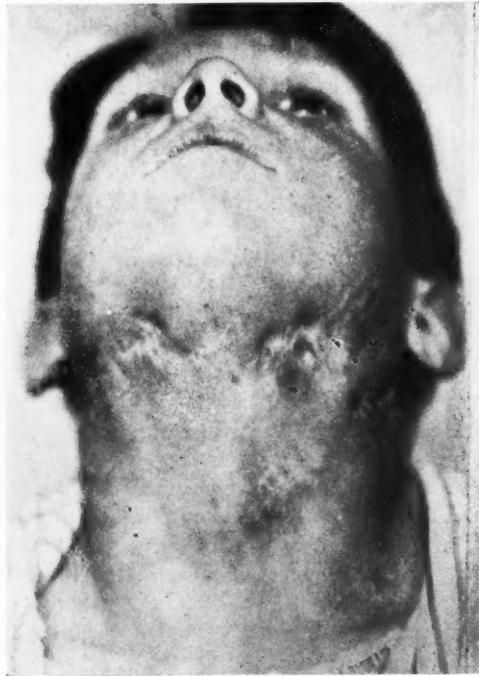


Fig. 23. Patient 8 years of age. Tuberculous glands with sinuses of 5 years' duration. Treated at a seaside hospital for two and a half consecutive years. Light baths and local light treatment 1918-1919 (14 months). Light baths, 157; séances, 190. Cured.

tionately equal in value to carbon arc lamps such as I have described.

*How long and how often are we to irradiate the patients?*

As has been mentioned, chemical light produces an erythema of the skin, stronger or slighter according to the time irradiated. Rollier is of the opinion that strong erythemas are to be avoided, but I do not agree with this view, for I hold that the best results are obtainable with carbon arc light, if a pronounced erythema is produced in the earliest stages of the treatment. Consequently, the first light bath which a patient gets is of thirty to forty minutes' duration; then we generally give the patient light baths every other day, increasing the time as we go on, so that after a fortnight's treatment fully two and a half

hours are reached, but this time is seldom exceeded. This method is used only when patients are non-feverish and not suffering from serious complications such as tuberculosis of the lung; in such cases we begin with baths of only fifteen to twenty minutes' duration, increasing slowly. With mercury light we begin with five or ten minutes, increasing slowly, for the erythema brought about by this light is extremely painful. During the irradiation the patients have to turn their bodies round, so that all parts of the body are irradiated.

In cases of pulmonary tuberculosis one has to be more cautious; we never begin with more than fifteen minutes, increasing very slowly to about one and one-half or two hours; the cases are to be controlled carefully, and the treatment to be stopped if patients get high fever or hemoptysis. After a time treatment can be recommenced, but I will admit that there are patients who are unable to support light bath treatment.

#### TREATMENT OF NON-TUBERCULOUS DISEASES BY LIGHT BATHS

The employment of light baths in treating heart disease has been mentioned already. With the dose here it is necessary to be extremely careful. One has to use long distance (1 to 1½ meters) and in the beginning to give very short irradiations (fifteen minutes), increasing the time slowly (five minutes every day) to one hour's duration. One has to produce an erythema, for the effect on the blood pressure and breathing depends greatly on the skin erythema. Carbon arc light is by far the best, and if mercury vapor light is used one has to be very cautious with the dose, five minutes or less in the beginning. If the patient has albumen in the urine light baths should not be used, for they then have a disastrous influence on the kidneys.

Amongst other medical diseases I would like to mention neurasthenia, where carbon arc light baths in many cases have an excellent effect. The depressed individuals,

unable to work, regain their good humor and strength again. The length of time for irradiation is about the same as in cases of heart disease.

In cases of simple anemia one has an excellent help in light baths along with the ordinary tonics.

*Rickets.* Light baths with carbon arc or mercury vapor light have an excellent effect here in always curing the patients. The doses need be very slight, fifteen to thirty minutes.

#### SKIN DISEASES

Light baths have in some cases of skin diseases a most effectual influence; I will mention here the neurodermitis (*Prurigo Vidal*), where without doubt the power of resistance of the organism is abated. In promoting this by carbon arc light baths, one can very often observe cures of these diseases. *Prurigo senilis* is generally cured by use of light baths. In psoriasis light baths with carbon arc or mercury vapor light can have a favorable effect, but a relapse is not to be avoided.

Some German authorities find a beneficial effect from light baths in treating nearly every kind of complaint, but I would most emphatically warn against this uncritical use of light. I feel sure that fresh fields are to be found for light baths, but the mentioned uncritical use of light is but harming a good thing.

#### CONCLUSIONS

1. Concentrated chemical light (carbon arc light) is indispensable in treating cases of lupus vulgaris and may be used in some other kinds of skin disease.

2. Light baths (sun or artificial) have always to be used in treating lupus vulgaris, other forms of skin tuberculosis and surgical tuberculosis. The non-operative treatment is the principal one in cases of surgical tuberculosis, not only in children but also in adults.

3. Light baths are used in many cases of pulmonary tuberculosis and tuberculosis of the throat.

4. Light baths can be used in many cases of non-tubercular diseases of internal organs as well as of the skin.

5. Carbon arc light can fully replace sunlight and is much superior to mercury arc light in almost all known forms of disease.

6. Sanatoria for treating different forms of tuberculosis should have artificial light baths at their disposal.

7. Light baths (sun or carbon arc light) have to be used for individuals suspected of suffering from tuberculosis.

## DISCUSSION

DR. A. J. PACINI (Chicago): The work of Dr. Duke, which has to do with the sensitization of the body to light through various naturally occurring or artificially introduced reagents, is of much importance at this particular moment by reason of a practice apparently gaining in use in which strongly sensitizing agents, such as eosin and mercurochrome, are being employed by intravenous injection and by the further reason that persons so treated may become exposed to ultra-violet radiation. No instances of lethal reactions from this cause have yet reached me, but I am informed of some violent symptoms which make it advisable to caution the users of intravenous dye injections of the possibility of so photosensitizing the body as to make exposure to light a serious procedure. Of course, we are all sensitive to light, and, moreover, we are all specifically sensitive to every wave length of radiation which comes to us from the lamp of the Heavens called "the sun." We are endowed with sense receptors specifically responsive to the radiation included in the region of heat; we are endowed with retinal structures sprinkled with visual purple specifically sensitive to the region of radiation designated "luminous rays"; we are endowed with sensory receptors scattered everywhere on the surface of the body and intimately co-related with the sympathetic nervous system specifically sensitive to the ultra-violet fraction of sunlight. Nat-

urally, therefore, the human organism is specifically sensitive to a wide range of electro-magnetic radiations in whose environment the intricate body structure has been molded and evolved. What is referred to in Dr. Duke's work is an unusual sensitization conferred upon the body by such products of physiologic disintegration as hematoporphyrin or such a substance foreign to the body as eosin. We have for some years purposely utilized the principle of photosensitization in the clinical warfare against bacterial infection. Most of the usual pathogenic bacteria are destroyed more promptly and more surely by light when they are bathed first in very dilute solutions of photosensitive dyes. The thought that purposeful photosensitization may become of clinical value was once held by the German school and later discarded by American investigators. The present tendency, mainly through the impetus of such work as Dr. Duke has to-day presented, is for the revival of a physiological mechanism which promises therapeutic potentialities.

Dr. Schmitz's work on the treatment of tuberculosis with the quartz light is important and in accord with the definitely established findings that many forms of tubercle infection yield more or less promptly under the specific influence of ultra-violet radiation. We feel that the spectral region responsible for this specific action has been definitely isolated by us, though we are not certain as to the method of its operation. It is not to be inferred that all forms of tuberculosis inevitably yield to quartz light treatment; but I think it is the opinion of those qualified to judge that ultra-violet radiation is capable of influencing the course of tubercle infections for great good. It is interesting to know that the ultra-violet region of the spectrum apparently responsible for such amelioration as is observed clinically appears to be practically identical with the region of the spectrum found at Columbia University, Johns Hopkins and Yale to be of specific value in the correction

of calcium and phosphorus metabolism in rickety dyscrasias.

The work of the Finsen Institute and of its illustrious representative here to-day, Dr. Reyn, is ever to be remembered for having awakened in the medical world a conscious realization of the potent curative quality of light. I am not of the opinion held by my respectful and unusual contemporary, Dr. Reyn, that the carbon arc lamp surpasses or even equals the mercury vapor lamp in bringing about certain specific physiological responses. It is a matter of common knowledge among photobiologists in this country to-day that definitely selective responses may be obtained in the human organism with definitely selected ranges of ultra-violet radiation. Some of these responses center around the unique region of the ultra-violet spectrum in which the group of bands where the wave length 2356 Ångstrom units is predominant. It is also a matter of common physical knowledge that the carbon arc lamp is deficient or lacking in this region of the ultra-violet spectrum which is most intense in the quartz mercury vapor lamp.

I think it is unfortunate that such comments as are made on the phototherapeutic results obtained in Switzerland by Dr. Rollier with sunlight, in Denmark by Dr. Reyn with the carbon arc, and in America by Columbia, Johns Hopkins and Yale with the mercury vapor lamp should be lacking entirely in any specification of the spectral qualities of the radiation used and of the intensity equivalents as expressed in such easily determined factors as the voltage, the milliamperage, distance and time. Sunlight alone can operate for good or for bad, sunstroke being an example of the harmful effect of sunlight. The total radiation of the carbon arc covers a range in which the rays producing thermal changes are abundant, and in this country we are steadily finding that diathermy is much more potent and admits of more precise use in the treatment of conditions in which heat is the desired essential. Certainly, in many respects, sunlight, carbon arc and mercury vapor

arcs can bring about practically similar therapeutic results; but this does not obtain in the case of definitely specific reactions attributable to ultra-violet wave lengths entirely absent either in sunlight or in the radiation from the carbon arc. I feel that much empiricism is prone to enter a discussion on ultra-violet therapy, and that the only solution which will permit of practical analysis and scientific evaluation of the important problem of phototherapy must come from a systematic endeavor properly to standardize the many intricate factors involved in the subject. Only when we have extended our knowledge about the specific physiological effect produced by any specific region of radiation can we begin to make intelligent comparisons on the relative therapeutic values of various light sources. Much is now being contributed to this study from which a science of phototherapy must inevitably emerge.

DR. H. J. ULLMANN (Santa Barbara, California): There are one or two points that are interesting me very much. There is one I have not heard brought up,—the apparent synergistic action of ultra-violet radiation and X-ray. This was shown very nicely during the last six months in the case of a patient of ours with a lupus erythematosus. We used X-ray first, with slight effect, then the quartz lamp. There was an improvement which continued for about two months, but not a cure. A few more pustules developed. We then put her back on X-ray, copper filtered, and almost immediately the lesions cleared up. I have noticed the same effect in acne. Our technic at present is to begin with the quartz lamp for a few treatments, then copper-filtered X-ray.

There is a use of the quartz lamp that I have not heard spoken of at any meeting—the treatment of poison oak dermatitis. We have lots of it in California; people will go out in the canyons where there is much poison oak. Last year we had to put in an extra lamp just to take care of the poison oak cases during the so-called poison oak



season. It is a specific if used early, and certainly benefits even in the older cases.

DR. A. U. DESJARDINS (Rochester, Minnesota): I was much impressed by Dr. Reyn's communication. In 1915 I had occasion to visit Dr. Rollier's Clinic at Ley-sin, in Switzerland, and to spend some time there. I was tremendously impressed by three things: At this clinic most of the patients are children. On arrival they are placed in a reception pavilion, not exposed to the sun, but in the open air. They are a pasty, sick, crying lot of kids and they make a distressing impression on anyone who is not used to it. After two weeks they are put on open balconies where the sun treatment is started, and within one month the attitude of those children has entirely changed. Instead of crying and howling all day long, they gradually take on a more contented look and begin to smile. Those children who have been there more than two or three months are about as happy a lot as anyone would wish to see.

Another striking thing is the large percentage of cases in which recovery of articular function is obtained. Of course, those cases in which bony ankylosis has already become established cannot expect return of function, but when the ankylosis is only fibrous, functional recovery is practically uniform. The third striking feature is that, in spite of the fact that so many of those patients were kept in bed immobilized in various types of apparatus, their muscular system developed as though they had been at hard exercise all the time. I should like to ask Dr. Reyn if the same is to be observed under the light treatment.

DR. FRED A. FORNEY (Woodmen, Colorado): We use the quartz light for both local and general application. I have seen two cases of tuberculous laryngitis in which the pulmonary condition was progressive. After local applications of the quartz light with the pharyngeal and the laryngeal applicators, the tuberculous areas showed healing by granulation tissue. The cases

treated have not been many. Tuberculous ulcerations of the epiglottis cause so much pain that it becomes practically impossible for some of these patients to take nourishment. By the use of a laryngeal applicator, the pain can be relieved to such an extent that the patients can take a satisfactory amount of food, both as to quantity and quality, so that they will not die from starvation.

The cases we have treated have all been relieved of their pain. We have two cases of glandular tuberculosis with discharging sinuses: one had two sinuses discharging from the neck, the other had four sinuses in the neck, one on the posterior part of the shoulder and four on the thigh. They were given treatment for about three and one-half months with the quartz light, then the weather conditions being favorable they were put on heliotherapy and continued for five or six months. At that time the weather became too severe for sun baths, so they were put back on quartz light. The sinuses showed improvement, though they continued to discharge for the first nine months, but at the present time all have healed except one sinus in one neck which moistens the dressings a little each day.

I am convinced that the quartz lights do have virtues that give us invaluable aid in the treatment of tuberculosis.

I would like to say one thing more before sitting down and that is that when you want to treat a case of tuberculosis with quartz light or anything else, do not do anything else in the course of that treatment that in itself is detrimental to the patient. Many of these patients are extremely ill when started on the quartz light, and if permitted to walk from their room to the light room, the exercise itself is enough to cause temperature. We put such patients in a wheel chair, take them to the quartz light room and return them to their own room in the same manner. I would like to emphasize that the fractional dose should be used at the beginning of treatment with the quartz light.

A couple of years ago we placed about fifteen patients on the roof in the sun and

instead of starting on the fractional doses, they were exposed all over the body, beginning with one minute and increasing with one minute a day. Within a week we had all of them back in bed running some temperature. In this series, I think the exacerbation was due to the exercise of going to and from the roof. Now when we take our patients down in wheel chairs, we have to discontinue only about 3 per cent of those started on the quartz light. We do not select that type of case which has a lot of proliferation of connective tissue,—they usually do well under the usual hygienic and rest treatment. We take only such cases as we are not "getting anywhere" with, and subject those fellows to the quartz light cautiously and carefully.

One patient whose normal weight was 195 pounds had been reduced by ill-health to 115 pounds. The physician in charge was discouraged and said that this fellow might as well go home as we could "get nowhere" with him. He had been given pneumothorax treatment, but showed no improvement. After that we started him on quartz light and he was eventually discharged from the institution with a normal pulse and temperature, but not very much gain in weight. The use of the quartz light certainly saved this patient's life.

I think of two other cases right now, one, a case of pneumothorax which had received air for three or four months and was not showing any improvement. Shortly after putting these patients on the quartz light they showed a general improvement and an ultimate gain of thirty-five or forty pounds in weight.

A few years ago in a certain type of intestinal tuberculosis, especially about the cecum, surgery was attempted, in the hope of giving the diseased parts of the bowel rest. At this time surgical procedure has been discontinued, I think, and those cases are being treated by quartz light and heliotherapy, and we are obtaining good results.

DR. W. S. LAWRENCE (Memphis, Tennessee): The question as to whether we should use carbon arc light or quartz mer-

cury, it seems to me, brings up the whole subject under discussion. To my mind it presents itself a little like this: Shall we use morphine or go back to gum opium? Our distinguished guest tells us that in using the carbon arc light we are using the nearest possible approach to sunlight. He also tells us that there are certain chemical rays in sunlight that we are after, and in all probability not all of the others. The quartz lamp, or the quartz ultra-violet generator, as I prefer to call it,—because we are not after light at all,—light is something that we can see,—is the nearest approach to the alkaloid out of the opium of sunlight.

DR. DUKE (closing): I wish to thank the doctors for their discussion of my paper. I have nothing to add except in support of Dr. Pacini's caution against the use of light therapy in cases that have been treated with dyes. Dyes and other photodynamic substances may remain in the tissues indefinitely, even for months. Physicians who use light therapy ought to know the danger to which they subject their patients under these conditions.

DR. SCHMITZ (closing): The message that has been conveyed to us this afternoon is the superiority of light therapy in the control of tuberculosis. We must be careful in the application of these rays, although it makes no difference what kind of rays are used. From the careless application of the rays very undesirable results may be observed. Radiations properly applied will benefit our patients, while the incorrect use of the rays will prove disastrous in the treatment of tuberculosis. This applies to the arc light, ultra-violet or quartz lamp and X-rays.

DR. REYN (closing): There are many questions asked, and I have only five minutes in which to answer them. I should say to Dr. Duke that this sensitization is a very interesting question, but I cannot comment upon it to-day. We have used many forms of sensitization at our institute, but one has

to be very careful not to harm the patient. Dr. Schmitz' cases were very interesting. Dr. Pacini says that he does not agree with me in my view of the light, and he tells me that we have to show what we accomplish. Now I must tell you that nobody knows, neither Dr. Pacini nor I, which rays are the most important for the cure of tuberculosis. You see, as I have already told you, that we have our results, which are clinical and not experimental, and therefore you cannot draw any conclusions from any experimental work for the moment. There have been so many experiments done and no one has been able to explain to us why the light cures tuberculosis; but we have seen that the light can cure it, and now we must see what we have to do to get the best results. We have the best results in the high mountains and at the seaside, where there is the most chemical light. Well, we must consider that it may be the chemical light. In the mountain heights you have an abundance of chemical light with waves of about 2,900 Ångstrom units, but not so many at the seaside. At the seaside the short waves are absorbed by the atmosphere, yet you get better results there than in the mountain heights. From these facts you conclude that it cannot be the best way to do the work—to use the short wave ultra-violet rays; but by using the quartz light, the air-cooled mercury vapor light, you use mostly the short wave rays which are not contained in the sunlight as we receive it on the earth, because they are absorbed by the atmosphere. I mean by this, that you can conclude that it must be the chemical light with not too short waves. I have had experience with that in this way: I have treated cases with mercury vapor light and carbon arc light, and I have had the following results with tuberculous glands: About 50 per cent of cures by mercury vapor light and 85 per cent by carbon arc light. That is why I think the arc light

is more penetrating. Professor Bovie has just said that it all depends on the absorbed rays. The mercury vapor light will be absorbed almost entirely in the corneal layer of the skin, but rays from the carbon arc will penetrate down through the skin, and the hard ultra-violet rays go a little deeper than the ultra-violet rays from the mercury vapor lamp. We have hard and we have soft ultra-violet rays, and the hard, more penetrating ultra-violet rays are the ones found in the carbon arc light. I can prove that by an example. Direct the light from a mercury vapor lamp on a rabbit's ear and put a piece of photographic paper on the other side of the ear. It will not get black. Substitute the concentrated light from the carbon arc for the mercury vapor light; in a few seconds the paper will be black. We have tried another thing: We have tried to treat two ears; we have put two ears together and treated one ear with mercury vapor light. After a long time we found a reaction on the second ear. But with the carbon arc light we get the same reaction in a very short time. Why? Because the mercury vapor light has only very few penetrating ultra-violet rays, but the carbon arc has many of them. Therefore always, if you would have good results, use carbon arc lamps for tuberculosis. You will get much better results than with the mercury vapor light.

Dr. Pacini spoke about rest; you know you cannot cure tuberculosis by rest alone; there are many other things. In that way you are right. Dr. Ullmann has spoken about ultra-violet rays and X-rays. I never treat lupus erythematosus with X-rays—I am afraid of the scars. Lupus erythematosus is a disease which, of itself, leaves bad scars, and I have seen so many cases where bad scars were left after treatment with X-rays, that I am afraid to use that treatment.

## DIVERTICULA OF THE DUODENUM<sup>1</sup>

By ADOLPH HARTUNG, M.D., CHICAGO

**D**IVERTICULA of the duodenum may be defined as circumscribed sacculations lying in close proximity to and opening into the duodenum. They owe their recognition *intra vitam* primarily to the roentgen ray. Formerly they were rare anatomic curiosities found at operation or necropsy; now they are detected with comparative frequency in routine roentgen examinations of the gastro-intestinal tract. A fairly extensive literature comprising isolated case reports and general discussions of them has accumulated, and it is the purpose of this paper to give a digest of it, together with personal observations relative to them.

Their discovery is generally credited to Morgagni, who described the first typical case in 1761. Up to 1911, Baldwin (1) was able to collect 67 cases, which he cites briefly. He reported 15 additional ones found in the course of 105 necropsies,—a high percentage of incidence, probably accidental, as it has never been approached even approximately by any other observer. Linsmayer (2) reported 45 cases among 1,367 necropsies. Case (3) was probably the first to recognize duodenal diverticula as such from the roentgen examination, as evidenced by his presentation of four cases in the Scientific Exhibit of the American Medical Association meeting in 1913. Subsequently he reported having observed 85 cases in 6,847 routine opaque meal examinations. Groover and Christie (4) found eight in 1,300 roentgen gastro-intestinal studies, and Watkins (5) four in 1,000. Cole and Roberts (6) in 1920 reported having observed 30 cases. My own files have yielded eight typical and several doubtful ones in about 1,500 examinations. From all available figures no accurate estimate of incidence is possible, but it is probably not much over 1 per cent. As compared to diverticula of the rest of the alimentary

tract only those of the stomach are of less frequent occurrence.

Most of the cases reported have been in individuals past middle life; Buschi (7) states that 80 per cent occur after fifty and Case gives fifty-five as the average age of his cases. The condition is usually stated to be more common in males, but in Case's series it was found that females outnumbered males three to two. The majority occur in the descending part of the duodenum and comparatively few in the ascending portion. Usually they are single, but as many as five have been recorded in a single case. Most of them project inward from the concavity of the duodenal loop or backward, but a few have been reported pointing forward or outward. At times they are located behind part of the pancreas or partly imbedded within it.

They are generally classified into congenital and acquired, according to origin, and into true and false, depending on their structure. True ones have walls similar to those of the duodenum; the false lack the muscular coat. Gant (8) states that the former are congenital and the latter acquired. Sturgis (9) believes that both false and true varieties may be either congenital or acquired. Davis (10) favors the acquired theory of origin, whereas Buschi is inclined toward regarding them as congenital. Others believe that a congenital defect is essential before they may be acquired. Detailed consideration of the various arguments advanced in proof of these different contentions is outside the scope of this paper. It seems probable that some diverticula of both the true and false varieties are congenital anomalies of development, be they attempts at the formation of an accessory pancreas or simple defects of the walls of the duodenum. Others, also true or false, are acquired, and have their origin either in a localized area of the duodenal

<sup>1</sup>Read before the Radiological Society of North America, at Kansas City, December, 1924.



wall undergoing some change which permits of pouching of the entire wall or a weakening or diastasis of the muscularis, permitting a herniation of the mucosa and submucosa. Increased intraduodenal pressure and lessened resistance in areas where vessels or ducts enter the duodenal wall and separate the muscle probably have an important bearing.

In the consideration of acquired diverticula no mention has been made of the so-called "inflammatory" varieties which have been appropriately named "pseudo-diverticula." They include sacculations formed by scars or adhesions from ulcers which have been called "ulcer diverticula," and funnel-shaped protrusions associated with adhesions, described as "traction diverticula." Real diverticula may be present with ulcers but not caused by them, as seems likely in cases reported by Jones (11), and Ritchie and McWhorter (12).

The question as to whether dilatations of the ampulla of Vater should be considered as diverticula is open to discussion. That they have been so considered is apparent when it is recalled that the ampulla is commonly spoken of as the diverticulum of Vater. Strict adherence to the definition of a diverticulum as being a blind sac would eliminate them from inclusion. However, a great many of the cases reported as diverticula are of this nature, as a study of Baldwin's cases will demonstrate. Most of these dilatations differ in shape from the ordinary by being funicular or tubular. Akерlund (13) has reported a case in which the end showed two horns, which he interpreted as being the openings of the common bile and pancreatic ducts, and Case (14) has shown an illustration of a supposedly double diverticulum of this nature. A variety of diverticula closely resembling dilated ampullæ has been described in which the common bile and pancreatic ducts open into the base of the diverticulum, or the latter has its ostium between the ducts. These probably correspond to the so-called "diverticules perivateriens" of the French.

The anatomy of diverticula is largely in-

dicated by their designation as true or false. In some instances of the false variety the mucosa has few or no Brunner's glands and valvulæ conniventes. The submucosa is commonly thickened and the muscularis frequently forms a sphincter-like ring around the base, or isolated strands of it may extend over the fundus. The presence or absence of a serous coat is dependent upon the location. Occasionally, the biliary and pancreatic ducts have been found within the walls of the diverticulum. In a case reported by Wilkie (15) a pancreatic rest was found within the fundus. The shape is usually round or oval and the size varies from that of a pea to that of a plum. They may be sessile or pedunculated and the ostium is either round, fissured, or irregular. The occasional co-existence of diverticula of the colon has been mentioned by Case and also observed by me.

The great majority of them have been found free from pathology when examined at necropsy. Rosenthal (16) reported a case in which there was marked inflammation of the mucosa. In a case of Bauer's (17) there were not only severe inflammatory changes in the diverticulum but the ampulla of Vater was swelled and glued together with mucus, causing dilatation of the pancreatic and biliary ducts. Basch (18) describes a case operated on in which numerous adhesions were present between parts of the duodenum and pylorus. Case has reported an instance where the sac was adherent to the pancreas and there was evidence of pancreatic involvement.

Attempts have been made to correlate diverticula with disease in a causal way. In a case of Bauer's the sac was filled with feculent material and was of such size and so located that it was thought more than likely that pressure was a pathologic factor. Case has noted the frequent coincidence of a chronic pancreatitis with diverticula. George, Leonard and O'Brien, in a contribution on the roentgen diagnosis of disease of the right upper quadrant, state that the filling of the ampulla of Vater may be a sign of gall-bladder disease. In one

of my cases, and several others reported, a carcinoma of the pancreas was found at operation or autopsy. In a case operated on by Basch, hypertrophy and dilatation of the duodenum were present proximal to the diverticulum, a fact which might readily be accounted for by pressure and consequent stasis. Akerlund (19) has endeavored to explain many of the commonly found associated lesions on the basis of recurring attacks of diverticulitis and a co-incident duodenitis.

The diagnosis of duodenal diverticula clinically is practically impossible. No uniform symptom-complex has been found associated with them. The syndrome most commonly present is a dull pain or feeling of distress in the epigastrium or back, coming on two or three hours after eating, lasting from one to two hours and not relieved by the taking of food or alkalies, and frequently worse at night. Occasionally there is nausea, vomiting, or gaseous eructation or regurgitation of sour fluid. Constipation is a common accompaniment. Usually there is no localized tenderness. Any or all of the above symptoms may be found with other conditions. Exceptionally there may be symptoms of an acute biliary colic, as in a case of Maclean's (20).

The roentgen diagnosis is dependent upon the visualization of a localized paraduodenal sacculation along which the contents of the duodenum are seen to pass. Inasmuch as nothing in the clinical history suggests their presence, the finding must be more or less accidental, and unless one is constantly alert to the possibility and uses every available means to render them visible, many a case will be overlooked. The prime essential in their detection is the filling of the sac with the opaque meal. Such a meal passing through an unobstructed duodenum may not enter the diverticulum in the course of a routine examination, either because of the direction of the sac and its opening, or because it may be filled with remnants of the previous meal. To render filling more certain, attempts should be made to distend the entire duodenum by

compression of the duodeno-jejunal junction against the spine and pressing the stomach contents toward the pylorus, as described by Case.

Roentgenoscopic examinations should be made in the vertical, the horizontal—prone and supine—and in oblique positions to render all parts of the duodenum visible. Frequently the first indication of a diverticulum is the finding of a localized residue after the stomach and duodenum are empty. Prolonged retention is very frequently present and has been noted for as long as four days. Tenderness to pressure may or may not be present over the sac; if elicited, the suspicion of a diverticulitis is justifiable. In some cases, an air bubble is found in the upper part of the sac. This has been noted especially in diverticula near the duodeno-jejunal junction. Akerlund (21) has reported such a case in detail because of its resemblance to four previously recorded ones by deQuervain and Schlesinger, which had been erroneously diagnosed as diverticula of the stomach and when operation failed to reveal them as such were ascribed to "functional" or "spastic" contraction of a part of the stomach wall.

Occasionally the making of a definite roentgen diagnosis of a diverticulum is extremely difficult. Cole and Roberts state that the diverticular pouch may so closely resemble the duodenal cap as to be mistaken for it. Assmann, in his text-book on Roentgen Diagnosis, calls attention to the occasional presence of air in the upper part of the duodenal cap and warns against the possible interpretation of it as part of a diverticulum. A localized spastic retention in part of the duodenum must also be ruled out. Anomalies of development in the form of unusual bends, loops and reduplications are probably the commonest cause for confusing shadows, inasmuch as the opaque meal may collect at the angles in sac-like accumulations. Andrews (22), in going over plates of 2,200 stomach cases, was able to find 300 deformed duodena, of which 26 resembled diverticula and 11 were stated to be such. Case, in discussing this

paper, doubted six of these. Occasionally partial obstruction of the duodenum may produce sacculations or result in prolongation and dilatation of it, producing kinks which retain their contents in a manner simulating diverticula.

In a differential way real diverticula must be distinguished from the so-called "pseudo" or "acquired inflammatory" variety. Niches, accessory pockets from perforated ulcers, sacculations from ulcer scars or adhesions usually are accompanied by other roentgen findings, such as filling irregularities, spastic incisura, fixation and tenderness to pressure, which make their recognition easy. Then, too, the history in most of these cases is fairly conclusive. Rarely a gall bladder filled with the opaque meal may require differentiation, as in a case reported by Shoup (23). In this case a stone had perforated into the duodenum and left a fistulous tract. Another rare source of error has been reported by Herrheiser (24), where a secondary carcinoma of the pancreas perforated into the duodenum and ulceration in it left a sacculaton which was seen at the roentgen examination. Gall, kidney and pancreatic stones, fecoliths and calcified glands may have to be differentiated, if first visualized in close proximity to the barium-filled duodenum. A film of the abdomen made routinely prior to the giving of the opaque meal usually obviates the necessity for differentiation in these cases. Otherwise, re-examination after an interval to permit evacuation of all the opaque meal usually clears the diagnosis. Lotsy (25) recently reported a case where a calcareous area in the duodenal wall, or calcified gland attached to it, closely resembled a diverticulum.

In view of the not infrequent finding of duodenal diverticula in the course of routine roentgen examinations of the gastrointestinal tract, the problem of a possible etiologic relationship to the symptoms in a given case deserves consideration. The fact that chronic pancreatitis and cholecystitis have repeatedly been found in association is probably more than a coincidence,

and it is not improbable that repeated attacks of diverticulitis and duodenitis may have a causal relationship thereto. Although the majority of diverticula are probably without clinical significance, some undoubtedly have such significance, for operative removal in cases reported by Moore (26), Forssell and Key (27), and Basch have resulted in apparent cure. Whenever no other pathologic condition is demonstrable clinically or roentgenologically to account for various indefinite and atypical symptoms in the upper abdomen and a diverticulum is found which is tender and retains its contents unduly long, operative measures for its removal should at least be given consideration. If operation is contemplated the findings should be verified by re-examination and special attention paid to location and movability, for operability may depend on these factors. Inability to find the diverticulum at operation does not necessarily prove the diagnosis to have been incorrect, as several cases are on record where this was the case and subsequent autopsy revealed the sac back of the pancreas or in an inaccessible location.

Among the cases observed by the author are the following:

*Case 1.*—Patient H. D., referred by Dr. W. E. Quine, October, 1917, male, aged 56. Symptoms began about twenty years ago, with indigestion. Had uncomfortable "pressing" feeling some time after eating, lasting about two hours. Gets some relief from alkali. Little eructation and regurgitation. No vomiting. Never sharp pain. Obstinate constipation. Not much improved by medical treatment. During 1916 had diagnosis of probable ulcer made with aid of roentgen examination. Received medical treatment in hospital lasting seven weeks, but had about same symptoms afterward, to time of this examination. *Roentgen findings:* Indications of old fibroid phthisis of upper lobes. Stomach showed ptosis, with hyperperistalsis and irregular contractions along greater curvature near pylorus. No fixed abnormality of contour. Duodenal cap regular and showed no signs



Fig. 1. Case 1, showing double sacculcation connected with descending portion of duodenum.

of ulcer. On descending part of duodenum a double sacculcation was noted toward median line, which retained opaque meal at



Fig. 1 (a). Case 1, showing six-hour retention.

time of six-hour examination when stomach and duodenum were empty. Its presence was verified by two subsequent examinations. Ptosis of colon, with stasis. Appendix visualized; not fixed nor especially tender. *Roentgen diagnosis:* Double diverticulum of duodenum, with probable adhe-



Fig. 2. Case 2, showing sacculcation connected with upper part of descending portion of duodenum.

sions. No definite ulcer signs demonstrable. *Subsequent history:* Operation was advised, and done. Surgeon recalls nothing of case except that appendix was removed. Patient states he was told sacculations were found, but inoperable. Felt better after operation, but still had "pressing" feeling. Came for second examination in March, 1921, at which time findings were much the same as before, plus some fixation of cecum. Diverticula of about same size as before. At present still has distress. Much constipation. Feels weak. Is up and around and looks fairly well.

*Case 2.*—Patient M. S. W., referred by Dr. A. H. Waterman, January, 1922, female, aged 60. Has had rather intractable



attacks of diarrhea for some time. Some indigestion, with indefinite symptoms. Pain after eating not relieved by alkalis. *Roentgen findings:* Stomach and duodenal cap negative. Probable adhesions in right

nausea. Constipation. Has maxillary sinus infection. *Roentgen findings:* Stomach and duodenum negative, except for detection of a sacculum in connection with second part of duodenum, about the size of a walnut,



Fig. 2 (a). Case 2, showing six-hour retention.



Fig. 3. Case 3, showing sacculum connected with lower part of descending portion of duodenum.

upper quadrant involving second part of duodenum. Sacculations noted at junction of first and second parts of duodenum, especially prominent at time of six-hour examination. Some gastric stasis. Colon contents presented stringy appearance in places, suggestive of mucous colitis. Adhesions in right upper quadrant probably involve hepatic flexure of colon. *Subsequent history:* Has had medical treatment, with general care, under which she has improved. Was practically well when last seen.

*Case 3.*—Patient H. F., referred by Dr. G. L. Brooks, February, 1924, male, aged 50. Has had so-called bilious attacks as long as he can remember, associated with severe headaches. Attacks have become progressively worse. Between attacks has some indigestion, distress at irregular intervals, one to two hours after meals, not relieved by eating or alkalis. Occasional

which retained contents over six hours, when stomach and duodenum were empty. Not tender to pressure. Corroborated by re-examination. *Subsequent history:* Treatment has been medical—dietetic, restrictions omitting starch especially—and exercise. Has been some better, and attacks have been less severe, but is still constantly conscious of “having a stomach.”

*Case 4.*—Patient M. N., referred by Dr. L. J. Pritzker, July, 1924, male, aged 56. Symptoms date back several years. Indefinite pains, usually some time after eating, not relieved by food. Some nausea, but no vomiting. Intermittent constipation and diarrhea. No localized tenderness. Some loss of weight and general weakness. *Roentgen findings:* Stomach negative except ptosis and slight stasis. Duodenal cap regular. Small sacculum in connection with upper part of descending duodenum.



Fig. 4. Case 4, showing sacculcation connected with upper part of descending portion of duodenum. Multiple diverticula of lower part of descending colon and sigmoid also present.

No retention. Some tenderness to pressure over it. Lower part of descending colon and sigmoid showed multiple diverticula. *Subsequent history:* Treated medically, and considerably improved when last seen.

*Case 5.*—Patient A. H., referred by Dr. F. A. Karst, November, 1921, female, aged 60. Has had trouble since about 45 years old. Nausea. Dull pain under right ribs. Bloating after meals. No vomiting. Noticed much mucus in her stools at intervals. Operated on for gall-bladder trouble about ten years ago. No stones found. Just drained gall bladder. Much improved for about two years; then had recurrence of old symptoms. Again noticed mucous stools. *Clinical diagnosis:* Mucous colitis. *Roentgen findings:* Stomach negative except for ptosis and slight six-hour stasis. Duodenal cap regular. On second part of duodenum two sacculations were noted which retained their contents for over twenty-four hours. Some tenderness to pressure over them. Colon negative except ptosis and evidences



Fig. 5. Case 5, showing two separate sacculations; one connected with upper, the other with lower portion of duodenum.

of spasticity, with stasis. *Roentgen diagnosis:* Diverticula of the duodenum. *Subsequent history:* Medical treatment, with



Fig. 5 (a). Case 5, showing six-hour retention.



Fig. 6. Case 6, showing small sacculcation connected with descending portion of duodenum.



Fig. 7. Case 7, showing irregular sacculcation containing residue at time of 24-hour examination. Also gastric residue.

regulation of diet. At present, well, if she is careful with diet.

**Case 6.**—Patient R. F. X., referred by Dr. L. L. Walls, February, 1924, male, aged 50. Had had a severe gastric hemorrhage short time previous, and symptoms fairly typical of duodenal ulcer, for which he had been treated. *Roentgen findings:* Stomach negative and duodenal cap showed no definite filling irregularities. In connection with descending portion of duodenum a small sacculcation—possibly a dilated ampulla of Vater—was found, which was still visible at time of six-hour examination when the stomach and duodenum were empty. Splenic flexure of colon displaced toward median line and faint outline of what was probably an enlarged spleen demonstrable. *Subsequent history:* Patient treated medically for time, and improved, and then passed from our knowledge.

**Case 7.**—Patient J. S., referred by Dr. A. R. Hollender, December, 1922, male, aged 60. Had jaundice and complained of indefinite symptoms in upper abdomen. Eructations of gas, but no nausea or vomit-

ing. Obstinate constipation and much gas in bowel. *Roentgen findings:* Stomach

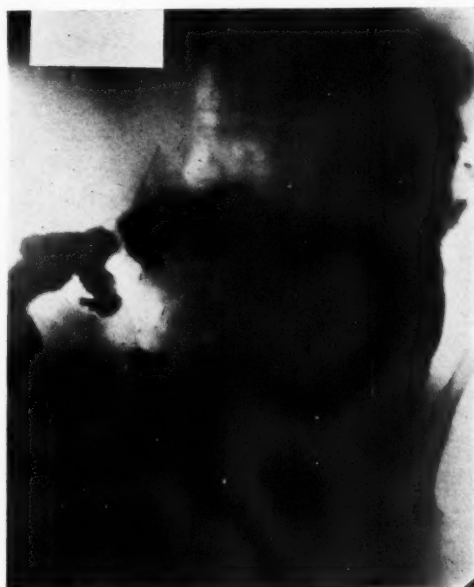


Fig. 7 (a). Case 7, showing sacculcation, with 24-hour retention, connected with second portion of duodenum after second meal had been given.

negative except marked ptosis, with stasis. Duodenal cap negative. Large sacculatation observed alongside of and connected with descending part of duodenum, which was still filled at time of seven- and twenty-four-hour examinations. Considerable localized tenderness over it. Probable adhesions to hepatic flexure of colon. Marked coloptosis and few small diverticula observed on lower part of descending colon. *Subsequent history:* Patient refused to consider operation, which was advised, and when last seen still had approximately same symptoms.

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## DISCUSSION

DR. RUSSELL D. CARMAN (Rochester, Minnesota): I do not know anything about the X-ray diagnosis of appendicitis, but we

see many diseased appendices removed at operation which had given rise to few or no symptoms. In this connection I may tell a story. One of the men working in the X-ray laboratory, in making a colon examination reported that the appendix was "long and fixed." Dr. Mayo, who operated on the patient for some other condition, and knew of the X-ray report, brought out a long, fat, freely movable appendix and remarked, "Yes, it is fixed so that he can't wipe his nose with it."

DR. L. T. LEWALD (New York): In regard to the X-ray diagnosis of chronic appendicitis, I would state that I have made a diagnosis in at least two instances on the opaque meal administered by another roentgenologist, and here is what is left in the appendix in one case. So I have learned the lesson of very carefully following up the meal and the small residue in the appendix. After forty-eight hours we are almost all of us prone to stop the examination, but I think that if we have a residue in the appendix at the time, and everything else has passed out of the colon, we should not neglect the follow-up of that case, and may be rewarded as I was in two or three instances. I have found in one case *four months' retention in the appendix*. Now there is no question that the removal of an appendix of that sort is absolutely indicated, and I have had the satisfaction of having the patient's symptoms entirely disappear after the removal of that sort of an appendix. Dr. Childs<sup>1</sup> has mentioned that the location of the appendix is important, and I would say that I know a good many other roentgenologists who feel the same way. *The exact location of the appendix prior to operation is sufficiently important to warrant the X-ray examination of every individual before operation for chronic appendicitis.* I have seen a surgeon go in and open the abdomen and then back out because he could not find the appendix

<sup>1</sup>The paper by Dr. Samuel B. Childs, "Appendicitis and Lesions Complicating its Diagnosis: Deductions from X-ray Examinations," was published in RADIOLOGY, February, 1922, page 107.



Now in such cases there is usually a non-rotation of the colon, so that the appendix is on the left side. Had the surgeon known that fact, a simple incision on the left side would have revealed the appendix, but having made a right-sided incision high up, supposing there was also a duodenal lesion, he could not reach the appendix.

The appendix in the next case goes way over to the extreme left. And here is an appendix that is in the chest. This is due to a hernia of the diaphragm with the appendix way up on the left side opposite the heart. Here is a case with a retention in the form of coated concretions, and these remained for a period of about two weeks. That patient has been perfectly well since the removal of his appendix. Here is a transparent spot that represents a concretion with barium beyond it and to the proximal side of it. This is a good example of a concretion which is shown by a negative density surrounded by the opaque material. Here is one of the cases of non-rotation of the colon, the cecum and appendix being on the left side. Altogether we have had about forty-five cases with the appendix on the left side; about thirty were cases of transposition of the viscera and the others were made up of nine non-rotations, such as this case, and the others apparently were movable cecum cases. The next case shows a concretion in the appendix. The density is equal to a ureteral calculus, but an opaque catheter shows it to be outside of the ureter. The surgeon in whose service this was seemed quite indignant because I held up the examination a day or two to determine whether this was a calculus in the ureter or not. We decided it was a concretion in the appendix and operation by Dr. Richard Derby proved it to be there. Concretions of this sort are quite large, so that that alone would make one suspicious, and as a rule they result from a perforation at the tip and slow coating with lime salts.

DR. E. W. ROWE (Lincoln, Nebraska): I doubt if I can add anything but I take it

from the general tone of the discussion that there is some question about the X-ray diagnosis of chronic appendicitis. It seems to me that there are a number of factors which are of importance, and one of them is the matter of the position of the appendix, which, when high and up in a part of the body where ordinarily it is not seen, certainly indicates that something is wrong. The position of the appendix from mal-development, rotation and descent is always abnormal. With fixation and localized tenderness, we can always add something to the diagnosis. Therefore, I feel that a roentgen interpretation of a pathologic appendix is not only valuable but highly diagnostic.

DR. P. M. HICKEY (Ann Arbor, Michigan): This is certainly a very interesting topic and one which concerns all of us in our everyday work. With regard to the point which Dr. Childs brought out with regard to the signs, the one that he mentioned, the segmented appendix, I think probably should be placed a little higher in his list, at least according to our experience and according to some of the published statistics. In England, where they have taken the X-ray signs of pathology in the appendix and checked them up carefully with operations on several hundred cases, they have found that the segmentation of the appendix was the most constant finding of a definitely pathologic appendix. The segmentations may mean one of two things: either scars from previous inflammatory action within the appendix or the presence of enteroliths which interfere with the drainage. I think we should indulge in the diagnosis of chronic appendix with the greatest caution, and unless we are conservative we are certainly making ourselves liable to criticism. If, at the end of a gastro-intestinal examination, we really feel compelled to say something and then finally report that the patient has a chronic appendix, oftentimes because that is the only thing we can find, we should not word

our report in a way which will lend undue importance to the findings.

DR. HARTUNG (closing): I have nothing more to add. I am sorry my paper did not bring out some discussion to get an idea of the frequency with which diverticula of the

duodenum occur, and, secondly, to ascertain whether any symptoms are commonly found associated with the condition. I am sure we would all find diverticula of the duodenum very much more frequently if we would look for them.

**Ovarian carcinoma.**—In a prognostic sense, cancer of the ovary is probably the most unfavorable of all forms of pelvic carcinoma. In surgical statistics, the percentage of relative cures within five years after operation fluctuates, the lowest figure of 8 per cent being recorded by Hoehne, as compared with 35 per cent by Fromme. Since ovarian carcinoma is a relatively rare disease, there is still very little information to determine whether radiation therapy can improve the prognosis. Only a few statistical studies embracing a limited number of observations have been published. Excluding the series of prophylactic post-operative irradiations at Bumm's clinic—with 50 per cent of cures after 5–8 years—the results have not been very encouraging. But during the last decade—when radiotherapy was first employed to any considerable extent—no investigator has commanded a noteworthy number of cases for a sufficiently prolonged period. From 1911 to 1922, inclusive, there were admitted to the Radiumhemmet in Stockholm 68 patients with the clinical diagnosis of primary ovarian tumor. In 53 of these, the diagnosis of carcinoma was established by histologic examination; in the others, no histologic diagnosis was made, but in only one of these was there a clinical suspicion of sarcoma rather than of carcinoma. Of all the patients, 28 (41.2 per cent) have survived to the present. Of 51 patients under observation for over two years, 20 (39.2 per cent) are living, and of 29 patients observed for more than five years, only 8 (27.6 per cent) have survived. The difference in prognosis between unilateral and bilateral involvement is evident from the survival rate. Thus, with unilateral ovarian carcinoma the percentage of survival in the same time was 56.1, 51.7 and 43.8 per cent respectively, and with bilateral involvement it was 27.3, 30 and 20 per cent, respectively. The cases were classified in

groups designated as inoperable cases (13), recurrence after radical operation (17), incomplete operation (20), and prophylactic post-operative irradiation (18). The survival rate for these groups in the same period has been (a) 15.4, 10 and 0 per cent; (b) 29.4, 28.6 and 10 per cent; (c) 35, 40 and 42.9 per cent, and (d) 77.8, 66.7 and 80 per cent, respectively.

The relatively favorable effects of radiotherapy after incomplete operation warrant the suggestion that an attempt be made to remove the principal tumor, even in hopeless cases, before irradiation is begun. The excellent results observed after operation with prophylactic irradiation, as compared with the average of 30 per cent of relative cures after surgical treatment alone, indicate the value of prophylactic irradiation. Most of the cases were irradiated with radium and roentgen rays combined, but some were treated exclusively by one or the other means.

Eventually, the standard treatment consisted of radium applications (intra-uterine, if possible) totaling 1,000–1,600 mg.-el.-hr., followed by roentgenotherapy over one or two abdominal fields and one dorsal field, 2 times 50 per cent or 3 times 33.3 per cent E.S.D. each, 23 cm. and 30 cm. focal distance, through 0.5 mm. copper filter.

More was apparently accomplished with radium (alone or in combination with roentgen rays) than with roentgenotherapy alone, and intra-uterine applications of radium yielded more permanent results (41.7 per cent without subsequent symptoms) than vaginal applications (25 per cent without symptoms).

JOSEPH MUIR, M.D.

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## EPITHELIOMA OF THE LIP

### OBSERVATIONS ON ONE HUNDRED AND FIFTY CASES

By WILLIAM H. KENNEDY, M.D., INDIANAPOLIS, INDIANA

**E**PITHELIOMA of the lip comprises, on the whole, about 2 per cent of all reported cases of malignancy, and—in conjunction with neoplastic growths in other parts of the body—its incidence is undoubtedly becoming more common, the frequency of its occurrence being out of proportion to the relative increase in population. As an increasing number of cases of epithelioma of the lip continually present themselves for treatment, the necessity for better technic and more competent handling of the condition becomes particularly evident. Hampered as we still are by the lack of definite knowledge regarding the etiology of these lesions, and, until recently, having no means of treatment which might be regarded as even reasonably reliable or satisfactory, progress has necessarily been slow. Those who have been most familiar with all phases of the condition, and who, therefore, were in a position to speak with greatest authority, have felt the need of caution in advancing along new lines, and, despite the most brilliant results in individual cases, these men have remained conservative in their attitude toward new methods.

The wisdom of such a stand should meet with general approval, for the fact that they

who had reason to believe they had “cured” a previously “incurable” disease were slow to blazon their success from the housetops, bespeaks the scientific spirit under which the investigations and experiments were undertaken, and, by the same token, enhances the value of the results obtained.

The use of radium in the treatment of malignancy is now long past the experimental stage. Of this fact there can be no question. We no longer ask ourselves whether radium shall be employed, but rather how it shall be used, how much radium, how often, and especially whether it should be used alone or in conjunction with other curative measures.

From the very outset radium has seemed peculiarly applicable to all malignant conditions of the lip. Even those who have remained skeptical as to its efficacy in all forms and stages of cancerous disease have admitted that radium is undoubtedly useful in the early stages of growth; and as a malignant condition of the lip is usually one of the earliest to be brought to the physician's attention, this fact may, to a certain extent, account for the marked success within this special area.

The reason for reporting this condition at an earlier stage than is frequent with



Figs 1, 2 (Case 1). C. M. S., age 49. Duration of lesion on lower lip, one year. At time of examination there was a circular lesion on right side of lower lip, slightly elevated and about 1 c.m. in diameter.



Figs. 3, 4 (Case 2). N. F., age 51. Initial lesion appeared about one year before examination, on muco-

cutaneous margin of lower lip, followed in three months by ulceration.

most malignancies can readily be understood. Any abnormality about the mouth is conspicuous and disfiguring, and moreover it constantly interferes with regular and important habits such as eating and talking, in consequence of which the person so afflicted will hasten in search of relief. If the case falls into the hands of a competent physician who is able to make a diagnosis, or, failing to do so, one who is willing to refer the patient to one who is qualified, the chances for ultimate relief are good.

The mortality rate from epithelioma of the lip is still much higher than it should be, considering the accessibility of the lesion and the opportunity usually afforded for early treatment. However, as radium ther-

apy has become more general, the published tabulated reports have coincidentally grown more encouraging, indicating that a larger number of cases of epithelioma of the lip are receiving earlier and more adequate treatment. Unfortunately, our statistics are still incomplete and proportionately misleading; but each year sees a larger number of cases reported and an ever-increasing percentage of "cures to date." Even the most conservative operators now admit that a person who has remained in good general health with no sign of recurrence for a period of five years or longer can rightly be considered *cured*.

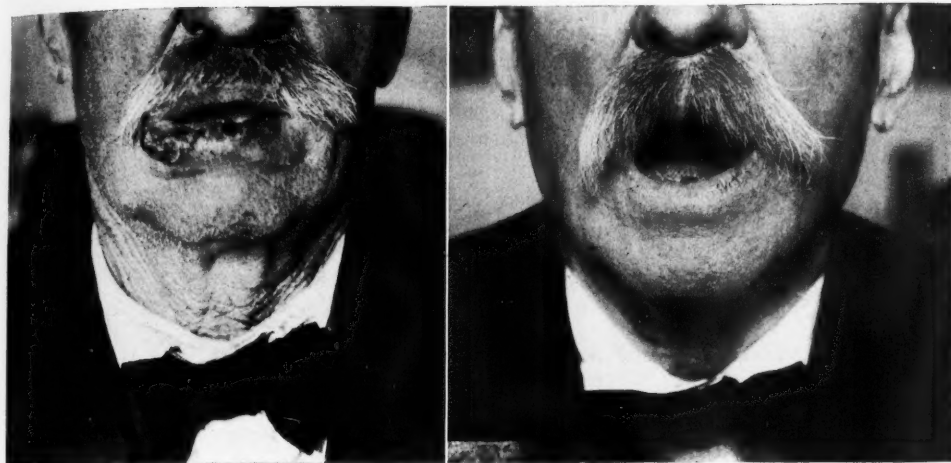
Epithelioma of the lip is essentially a disease of middle life, although it occasionally occurs in the aged and, very excep-



Figs. 5, 6 (Case 3). A. H. D., age 62. Initial lesion keratosis, followed by ulceration, and at the time of

examination there was a roughly circular lesion in the middle of the lower lip with considerable destruction of tissue.





Figs. 7, 8 (Case 4). D. C., age 75. Initial lesion a scaling patch which eventually ulcerated, located on the left side of lower lip, later extending across the entire lip.

tionally, in young people. It is frequent in both sexes, priority being claimed for males. Brewer (1) in a series of 981 cases at the Presbyterian, Roosevelt and General Memorial Hospitals, reports 95 per cent occurring in males. This writer also found cancer of the lower lip to be twelve times as frequent as cancer of the upper lip.

The etiological factors in the production of this condition are still causing considerable discussion in all quarters. Although the use of tobacco—pipe-smoking especially—has long been regarded as being chiefly responsible for the appearance of the lesion in this particular locality, a sufficient number of cases have occurred in persons who never use tobacco to disprove this theory. And whereas smokers' burn has been given a prominent place in the etiology of cancer of the lip—benign in the beginning but later developing into a malignancy—the writer's personal experience leads him to conclude that the importance of tobacco in the causation of this condition has been overemphasized. In examining the histories of the 150 cases on which this article is based, it has, therefore, been concluded that the predisposing causes are undoubtedly of a complex nature and that no single agent can be held exclusively responsible for this malignant state of the lip nor of the cancerous condition elsewhere in the human organism.

Inasmuch as irritation or trauma may serve to aggravate an existing condition, leading, finally, to the cancerous state, a vital problem—if this theory is correct—would be the determination, if it were possible, of the pathological condition of the precancerous state and of its origin, before the advent of this contributing factor.

Among the many theories presented on the subject is the inheritability of the tendency to spontaneous cancer in man. In a recent noteworthy article, Maud Slye (2) has recorded at great length a series of experiments and studies on mice, demonstrating this theory conclusively, according to this writer. Coincidentally the fact is pointed out that this premise must necessarily serve as strong evidence against the validity of the theory of cancer as a specific germ in the causation of this disease, as held by many writers. On the other hand, Ewing in his book on Neoplastic Diseases contends that a demonstration of the inheritability of cancer in mice—a fact quite generally conceded—seems to him to have no bearing upon the question of the inheritability of cancer in man, thus presenting, once again, both sides of the question, ably contested, for our choosing.

With many other observers, Ochsner (3) believes in the infectiousness of cancer. In this view he claims to be substantiated by



Figs. 9, 10 (Case 5). A. A. L., age 44. Lesion appeared on muco-cutaneous margin, left side of lower lip, about nine months previous to examination.

"the studies of Professor Smith, who has proved to the satisfaction of those competent to judge, that cancer in plants is due to a micro-organism which he has been able to isolate and cultivate, and which produces cancer when inoculated upon healthy plants." Ochsner urges that further studies in human cancer be made on this basis, thereby furthering the work already done by Roppin, Schill, Francke, Lampiasi, Scheuerlen, Konbassoff, Doyen, Wickham, Thoma, Sjobring, and numerous other observers. Here, once again, the question is raised as to whether results obtained in connection with cancer produced experimentally may be considered as conclusive evidence in a consideration of cancer in the human body. Is there not some influencing element or elements in the human organism which are lacking in the make-up of the lower animals and the vegetable kingdom?

The theory that cancer is a systemic or constitutional disease is also rather largely subscribed to. Bulkley (4) likens the condition to tuberculosis, in that it is a product of civilization, it being the result of debased nutrition, with too much food, or the wrong food, combined with underwork or indolence. He holds that the newer methods of transportation of foods, particularly in connection with cold storage, over-indulgence in animal foods, the refining of flour—by which the valuable potash salts and protein found in the germ and the husk

are eliminated—hasty eating, improper mastication and poor insalivation, inattention to the bowel and kidney action, and the like, are additional contributory factors in the production of the faulty blood current leading up to cancer.

By way of citing another of the numerous views on the etiology of the cancerous condition, reference to a recent article by Bauer (5) may be of interest. This writer ascribes the immediate cause of the malignant state to a lowering of the surface tension of the tissue fluid, contending that it is the tissue fluid, and not the cells, which are responsible. His experiments demonstrate the fact that this isolates the cells and increases their tendency to divide. Bauer has found the average surface tension of serum from patients suffering from cancer to be lower than in normal subjects.

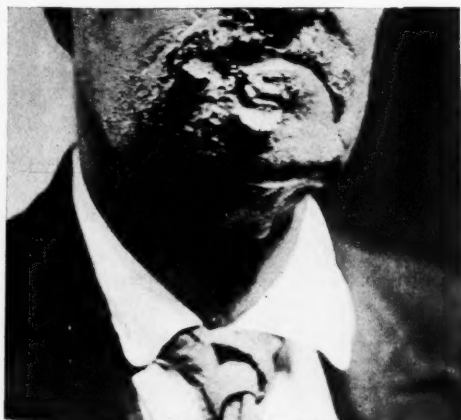
These scattered references will serve to suggest the trend of opinion which exists at the present time, indicating, above all, that, although a tremendous amount of earnest work is being done, no theory yet presented has been universally approved. How long we shall have to wait until the advocate of the cellular theory, the theory of inheritability, the metabolic theory, the theory of infectiousness, or one of the numerous others already presented or still to be presented, shall prove conclusively that his stand is tenable, is one of the most impelling questions of the age.

In connection with the question of treatment of epithelioma of the lip, it is a fact that, until six or seven years ago, surgery was practically the only acknowledged means of relief in the treatment of this form of carcinoma. Notwithstanding this fact, however, the mortality rate remained high and recurrences were distressingly frequent. Previous to this time—in fact, as early as 1908—Pusey and others had reported success in combating epithelioma of the lip by means of X-rays, but results, on the whole, were discouraging. Surgery supplemented by X-rays apparently gave better results than either means employed alone. In this connection Pusey is reported to have stated that although, in an experience covering several hundred cases, he had treated many rather deep nodular masses of carcinoma of the lip with X-rays, in his judgment these cases required some other form of preliminary treatment, some means of radical destruction, as far as possible. "Whether this be done by electrocoagulation, surgery, or some other method of destruction is a moot point" (6). In Dr. Pusey's opinion, however, the claims of surgery are stronger than those of electrocoagulation.

Electrocoagulation, which consists in the coagulation of the diseased areas by means of heat produced by the high frequency cur-

rent, in the hands of Dr. Pfahler has given satisfactory results in selected cases, the Oudin current (unipolar) being employed for small lesions and the d'Arsonval current for larger ones. The heat is generated in the tissues, and the penetrating value of this form of heat is greater than that obtained by thermocautery, which destroys only by transmitted heat. Pfahler believes that in properly selected cases the destruction following electrocoagulation combined with the gamma rays of radium or the high voltage X-rays over the adjacent tissues and the associated lymphatic areas will be more prompt and satisfactory than can be obtained by radiation alone (7). From the viewpoint of our own experience we have found radium most efficient in practically all cases of epithelioma of the lip; consequently we have had to resort to the use of electrocoagulation but seldom, although, in these few cases, with satisfactory results.

Even those who still regard surgical intervention as offering the best means of cure in epithelioma of the lip, are more and more inclined to make use of other therapeutic agents in conjunction with it. In an experience covering the treatment of more than two thousand cases of malignancy, the writer has reached the conclusion that epithelioma of the lip can be treated most successfully by the use of radium exclusively; and in the handling of the 150 cases which



Figs. 11, 12 (Case 6). S. E. Initial lesion appeared on muco-cutaneous margin of the lower lip, near the right angle of the mouth. It consisted of a small warty growth, which gradually increased in size and eventu-

ally ulcerated. Locally a large ulcerating, fungating growth was present which occupied the entire right half of the lower lip, extending on the cutaneous surface practically to the margin of the chin.

formed the incentive for this article, radium was the sole therapeutic agent employed.

In January, 1918, it was decided to use radium, to the exclusion of all other therapeutic measures, in the treatment of all forms of cancer, and this was done with the definite idea of thus determining the agent which, in the last analysis, would be productive of a successful outcome. Working along these lines we have been able to determine those types of malignancy which, we believe, must of necessity have the benefit of other curative agents before we can hope to equal the satisfactory results which radium—unsupplemented—has given us in cases of epithelioma of the lip. The technic which we have employed has undergone many changes and modifications, since we have availed ourselves of the knowledge which other workers have placed at our disposal. Healthy tissue in different subjects reacts in various ways to the radium rays; and, similarly, the effect of the latter upon different types of malignant tissue may be expected to vary in different subjects. We have seen lesions which disappeared after a very small dosage; in other cases, a maximum radiation wholly failed to destroy them. It is a common experience that a growth which shows rapid development often yields more readily to radium treatment than will an innocent-looking lesion of small proportions. In fact, it is not unlikely that certain apparently trivial growths may actually be stimulated by insufficient radium application.

When, as is often the case, these patients are sent to the radiologist as the last resort, every other curative means having proven of no avail, brilliant results cannot, naturally, be anticipated. If we could always select our cases carefully, it would be a simple matter to be able to attain success in every case; but even in unselected cases results have been excellent, and the percent-

age of cures is extremely gratifying. It has been our experience that for the special form of malignancy under consideration in this article, the surface application has decided advantages. Some radiologists have employed needles in administering radium, but the latter method has seemed to us to cause avoidable destruction of the surrounding normal area. In this group, surface applications of 50 mgs. of radium element were made, with filter of one-half millimeter of silver, one millimeter of brass, one millimeter of lead, and two millimeters of soft rubber, applying same two hours each day for five consecutive days, which is our routine technic for such cases as 1, 2, 3 and 4. In Case 5 the same technic was followed on both sides of lip. In Case 6 a like amount of radium with same screening was used but necessitated raying three areas due to the extensive involvement. Our experience has taught us that the above technic can be used in practically all cases with the assurance of a favorable prognosis.

A brief summary of each case accompanies the figures.

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## THE TEACHING OF RADIOLOGY TO UNDERGRADUATES<sup>1</sup>

By J. H. DEMPSTER, M.D., F.A.C.P., DETROIT, MICHIGAN

NO ONE will deny the importance of instruction in this — among the most recent additions to specialized knowledge in medicine and surgery. In the teaching of medicine and surgery, we do not aim, especially in the undergraduate period, to produce specialists. The object of all undergraduate medical education is to give the student a view of the whole field of medicine and surgery. The breadth and depth of that view depend upon his ability to assimilate what is given him in four or five years of study in the professional school. The extent to which radiology should be taught should be commensurate with the time and stress given the other subjects of the medical curriculum, with the exception of the practice of medicine and surgery. In many schools the amount of time accorded radiology is not more than one hour a week for a college year, supplemented with the examining of radiographs illustrating medical or surgical cases assigned to the student.

The question before us resolves itself into, How can the time at our disposal be best spent in the interests of the student, who will shortly assume the responsibilities of the general practice of medicine? Of this time, some attention should be devoted to the history of radiology, including also the period before the discovery of the X-rays, the work of such men as Geissler and Sir William Crookes. A very interesting as well as useful lecture would consist in correlating the special work of Roentgen and that later of Mosley, Darwin, Laue and Sir William Bragg, with that of the physicists before Roentgen's time. We should not neglect the contributions by various physicians to the results of clinical research. In the historical approach to all departments of medicine, witness how admirably Osler has carried out the idea in his well known work on Practice.

The academic subjects ancillary to radiology which our student has already stud-

ied are physics and anatomy. The requirements for premedical education which prevail in this country include one year of college physics. Before the student has reached his third year in medicine he may be presumed to have made a complete dissection of the human body. From his knowledge of physics, the instructor should develop the importance of protection both to patient and to operator from the X-rays and radium and from high tension current. The importance of this cannot be overestimated and it is better impressed by spending time to show the reason than by merely labelling the dangerous parts of an X-ray machine with such laconic admonitions as, "Hands Off!" "Look Out!" "Danger!" With the extension of the use of X-rays and radium as therapeutic agents, the fact that we have in our hands a double edged sword further emphasizes the need of instruction regarding protective measures. Even now radiology is being regarded as out of the ordinary by insurance companies carrying medical protective risks.

The medico-legal aspect of radiology should be carefully explained. Let this include, among other things, the ownership of X-ray films; the radiologist as witness in court; statutes of limitation as they obtain in various states with particular reference to accident cases; the duty of the radiologist to preserve carefully all records, particularly those pertaining to medico-legal cases, and it should be impressed that all cases in which personal injury is involved are potentially medico-legal.

We might also include in our program the subject of medical ethics as it relates to X-ray work. Here we emphasize the fact that the radiologist is a consultant to medical, surgical and kindred specialties, that his relations are entirely with the physician or surgeon, as the case may be, and not directly with the patient. It may be further explained that this function of consultant can never be properly performed by a commercial X-ray laboratory. No

<sup>1</sup>Read before the Radiological Society of North America, Kansas City, December, 1924.

physician or surgeon should entertain the idea of employing a commercial X-ray laboratory operated by laymen any more than he would think of calling the same persons in consultation in a case demanding diagnostic skill. The radiologist as consultant is entitled to all clinical data as well as laboratory findings, the same as furnished to a medical or surgical consultant.

The X-ray curriculum should include a study of anatomy from the X-ray viewpoint, which is that of density of the structures examined. This will include a study of progressive changes in skeleton as seen at various ages, manifest in the epiphyses. The impression that a radiograph is a record of density and not a photograph, should be driven home. I think we should use the word "radiograph" in preference to "picture." We would then get away from the idea that a radiographer is a sort of glorified photographer. The early work of Cannon and the work of every radiologist almost since the first diagnostic use of the X-rays, have demonstrated that certain data of physiology can be obtained in the visualization of such viscera as lungs, heart, and alimentary tract, as well as the functioning of joints and other moving parts. With the fluoroscope the physician may perform a biopsy which is painless so far as the patient is concerned. The fluoroscope and the radiograph have given us certain anatomical and physiological facts which cannot be obtained in any other way. Hence the importance of this means in the teaching of normal anatomy and physiology. We should acquaint the student with the normal from the particular viewpoint of our specialty.

A long recognized pedagogical principle is, "The teacher should proceed from the known to the unknown." In other words, a knowledge of the physiological should precede that of the protean results of disease and injury. Instruction, it goes without saying, should be as far as possible by means of illustration. A single illustration gives a more accurate idea than any purely verbal description can possibly do. Radiographic films, lantern slides, the

fluoroscope, models, the various structures of the human body itself are the means to be employed in class instruction.

In addition to the didactic lecture, the senior class in particular may be divided into smaller sections or convenient groups for more intensive instruction in radiographic interpretation, which should be given in the regular routine work of the hospital where students receive their clinical instruction. The correlation of X-ray findings should be made with other clinical data in working up case histories.

An important field with which physicians should become acquainted in their undergraduate years is that branch of therapeutics in which radium and the X-rays are the agents. This is essentially the field of the radiologist rather than that of the instructor of drug and general therapeutics. Inasmuch as the radiologist is a legally qualified physician, with greater or less experience in the practice of medicine, he is logically the person who should teach this branch of therapeutics. The physiological action of radium and the X-rays should not be approached in an empirical way but by as thorough a knowledge as possible of the action of these agents upon live animal tissue. The principles of the subject are clearly discussed in such works as those of Kaye, and Colwell and Russ.

Mention of technic in either radiography or radiotherapeutics has been purposely omitted since this concerns only those actively engaged in the operation of X-ray apparatus or who work with radium.

From what has been said, it may be gathered that the object of undergraduate teaching is not to make specialists, but to give some understanding of the scope and limitation of the X-rays as diagnostic agents and of both X-rays and radium as therapeutic measures. It is hoped that such instruction will lead to more intelligent cooperation and understanding between the physician and the surgeon on the one hand, and the radiologist on the other, and that it will translate the language of the radiologist into terms significant to the clinician and surgeon.

## EDUCATING THE PRACTISING PHYSICIAN AS TO THE VALUE OF RADIOLOGY<sup>1</sup>

By HAROLD SWANBERG, B.Sc., M.D., QUINCY, ILL.

RECENTLY I made a survey of the age of every practising physician in Adams County, the county in which I practise, and also the number of years that these physicians have been in practice. For the city physicians the average age was 49.9, with 25.5 years of practice; for the country physicians it was 54.5 years of age, with 27 years of practice, the grand average being approximately 51 years, with 26 years of practice. In other words, statistics showed that 1873 was the average year of birth and 1898 was the average year of graduation from medical college. It should be borne in mind that these statistics include only *practising* physicians, all retired physicians or those not engaged in actual practice not being included.

While it is not definitely known how the above figures compare with those of other sections of the country, they do, in all probability, represent a fair average.

The X-rays were discovered by Roentgen in December, 1895, and radium was discovered by the Curies in 1898. Thus it will be seen that the X-rays were discovered only a year or so before the average physician in active practice to-day was graduated from medical college, while radium had just been discovered. Roentgenology was hindered in its early development until after 1907 because of inadequate apparatus. In that year Snook perfected the interrupterless type of transformer, which was simple to operate, easily controlled, and which enabled us to deliver large quantities of electrical energy continuously over prolonged periods without variation in voltage. Radium therapy, likewise, was hindered in its early development until after 1910, because no standards of measurement were used. In that year the International Radium Standard was adopted, enabling all to speak in the same terms

when referring to the amount of radium they were using.

All of the above is interesting because it shows that the great developments in radiology did not begin until a decade or more after the great majority of physicians in practice to-day were graduated from medical college. In fact, only in very recent years has any instruction in regard to radiology been given in our medical schools, and even now it is very meager in many. Consequently, the knowledge of radiology that the general medical profession, as a whole, has to-day, is that which they have "picked up" as best they could.

Radiology as a specialty is essentially a consultation practice. Consequently, the great majority of patients in need of radiological examinations or radiation treatment, learn so only through the family physician. The practising physician, therefore, determines to a very large degree just what cases will or will not receive the benefits of radiological methods. Yet these physicians have not received any systematic course of instruction in the indications *for* and limitations *of* these methods. This being the case, is it not of the greatest importance that the radiological profession take an active interest to educate physicians as to the value of radiology? How best can this be accomplished? The following outline may serve as a guide:

1. *Education of undergraduate students.*—While we cannot hope to give personal courses in the value of radiology to those already graduated from our medical schools, we *can* urge that every medical college establish an adequate course in radiology. This should be conducted by an experienced radiologist who is making this specialty his life-time work. It should not be the purpose of such courses to turn out radiologists, but to so educate the future physician that he will have a correct appre-

<sup>1</sup>Read before the Radiological Society of North America, Kansas City, Missouri, December 9, 1924.

ciation of the indications for roentgen examinations and what he could learn from such studies, as well as the indications for and results of radiation therapy. I believe our national radiological societies should make an investigation of the courses being offered in the medical colleges and attempt to standardize them, if possible. This certainly would be a step in the right direction. Much good work can also be accomplished in an educational way by the radiologists in hospitals having interns.

2. *Reading of papers before medical societies.*—Every radiologist should endeavor to accept every invitation he receives to read a paper before a medical society. Such opportunities offer the best possible means of spreading knowledge concerning the science. In fact, it is imperative that the radiologist be a faithful attendant at his county medical society meetings in order that he may take part in discussions when questions arise concerning radiological methods. This also applies to hospital staff meetings, etc. In fact, the matter of having a member or members especially delegated to attend every national and state meeting in order to be sure that the science of radiology is adequately represented, in case questions concerning radiological methods come up for discussion, might be considered seriously by our national radiological societies.

3. *Contribution of papers to medical journals.*—Every radiologist should endeavor to have every paper he reads published in the official journal or bulletin of the society before which it is read. To be sure, most of these papers will not contain new information, but that is not absolutely necessary. Such articles help to keep the practising physician informed and reminded that there is such a science as radiology. The establishing of radiological departments in some of our medical journals, under the editorship of competent radiologists, is a splendid step in the right direction and is to be commended.

4. *Joint meetings of radiological and medical societies.*—The radiological pro-

fession should be organized in every state and in all the larger cities. This is rapidly being accomplished. These societies should not fail to endeavor to arrange joint meetings with the various local medical societies each year or so. Such meetings usually bring out a good attendance and afford an excellent opportunity to exchange ideas. Our national and sectional radiological societies should always endeavor to arrange a joint meeting with the local medical society in the city in which they meet. If one evening of each such meeting were devoted to this purpose, it could not help but spread a better knowledge and appreciation of radiology. We have not taken advantage of these opportunities in the past as much as we should.

5. *The publication of a radiological journal for the practising physician.*—I have felt for a number of years that there is a distinct need for a publication on radiology devoted entirely to the practising physician's viewpoint; a journal devoted to the progress of radiology and edited especially for the general practitioner and various specialists, other than radiologists, interested in keeping up with the progress of our science. Such a journal would fill an hiatus in medical literature heretofore not filled. While it is true we have had our own special radiological journals for years, the articles therein are usually so technical and frequently of such length that the general practitioner will not take the time to read them. All this is readily understood, because such journals are primarily edited for the radiologist himself. It is impossible to appeal equally to the two classes of practitioners with the same type of journal.

Such a journal as I describe should not be too large or issued too frequently, because that discourages reading on the part of many physicians,—not having time to read *all*, they frequently fail to read *any* of it. Such a journal should be welcomed by the general practitioner because it would virtually mean that with one or two hours' reading every month or so he could keep



himself fully informed as to the progress of radiology. This enables him to render a far greater and more intelligent service to his patients and also feel assured of what value the radiologist can be to him.

The rapid development in X-ray and radium during the past decade has taxed the energy of the radiologist himself to keep up-to-date. So rapid has been its progress that the great mass of general practitioners do not realize the possibilities of the X-ray as an aid in the diagnosis of many conditions, nor of the various indications for roentgen and radium therapy. This lack of proper knowledge of radiology on the part of the physicians in general practice—the men who refer their work to a radiologist—causes much unnecessary suffering and incidentally results in a considerable financial loss to the radiological profession.

Radiological knowledge is so commonplace among radiologists that they frequently fail to realize how comparatively uninformed many physicians are concerning radiological methods. Do you know that there are thousands of physicians in practice to-day who do not know or appreciate the fact that pneumonia can easily and quickly be diagnosed by a radiological examination, that gastric ulcer and cancer can be successfully diagnosed earlier by roentgen methods than by any other single method of examination, that radiation therapy is practically a specific in most superficial malignancies, menorrhagias, etc.?

Every conscientious physician realizes that radiology is an important specialty; that efficient and adequate apparatus is so expensive and the time to acquire the knowledge to properly interpret radiographs and administer radiation therapy understandingly is so long, that he does not have time to devote to the work and must of necessity rely upon the radiologist to aid him in giving his patients the maximum efficiency from this method.

Granting that I have proven that there is a need of a radiological journal for the

practising physician, the next question is, How are we going to get it to the practising physician? Personally, I feel that the least every radiologist can do is to keep his physician-patrons informed as to the progress of his specialty. It is not only good business for him to do this, but to whom else is the practising physician going to look for new radiological information if not to the radiologist to whom he refers his patients? If such information comes to him regularly, in a concise form, he cannot help but appreciate this effort on the part of the radiologist to keep him properly informed concerning his specialty.

#### CONCLUSIONS

1. The great majority of physicians practising to-day received no information concerning radiology while they were medical students.

2. The education of the medical profession to a better knowledge of radiology can be secured by adopting the following methods: (a) An adequate course of instruction in the practical uses of radiology in every medical college by an experienced radiologist; (b) The frequent reading of papers by radiologists before medical societies; (c) The frequent contribution of papers to medical journals by radiologists; (d) Frequent joint meetings of radiological and medical societies; (e) The publication of a radiological journal especially edited for the practising physician.

3. Radiologists must realize that the great demand and call in every business and profession to-day is *service*. In our profession it is service, in the spirit of educating the physician to a better appreciation of the value of our specialty. There is a compensation for this, direct and indirect. Ethical practice forbids undue publicity. The professional dignity tolerates no commercialism. But to fail to freely disseminate our knowledge to those who should know about it is an injustice to humanity and to the development of the science. The continued rapid growth and progress of

radiology depends in no small degree on the education of the general practitioner to a greater appreciation of our specialty. The radiologist should render this educational service in a spirit of unselfishness and without thought of remuneration. This eventually cannot help but reflect the ultimate good of the science and do much to advance its cause. Radiologists will profit by remembering and following the slogan of the Rotary Club: "He profits most who serves best."

#### DISCUSSION

DR. P. M. HICKEY (Ann Arbor): This subject is, of course, of great importance to the radiological profession, in view of the fact that the future of radiology depends upon the education which our medical students receive at the present time. The purposes that I have tried to put forth in my efforts in teaching are, first of all, to teach the student the difference between good X-ray work and poor X-ray work. There is a great deal of very poor X-ray work being done throughout the country especially by those who buy machines and who use their X-ray machines as an additional means of livelihood in addition to other branches of work. I see that particularly evident in films which are sent to me by physicians who are not specialists in radiology, but who have bought a machine and wonder what it is all about. Some of those films, of course, are very poor, so we try to demonstrate to students the need of careful work in using the X-ray as a means of diagnosis. Personally, I find that students are very eager to absorb as much X-ray knowledge as they can during their college course. As an instance of that, I will state that out of a class of, say, one hundred and forty seniors, we had sixty students who, in addition to their required work, elected special courses in film-reading, being anxious to learn as much as they possibly could about interpretation. This, I think, is a very good evidence of the way the future physician is going to regard the importance of roentgenology. I again express my

pleasure at having heard Dr. Dempster's paper, as I endorse all that he says.

DR. I. S. TROSTLER (Chicago): On account of the shortness of time due to the fullness of our program I will say only a few words. This subject is rich with opportunity,—the proposition of presenting our line of medical practice to the general practitioners. We have been too lax and too backward in showing our faces at the general medical meetings and in my opinion the time is ripe when we should present radiology to the profession at large and take a more active part in the proceedings in the meetings of the general medical men. This will redound to the benefit of medicine and to radiology as well.

Dr. Swanberg has been bashful about a matter that really should be called more to your attention. He has started just such a magazine as he describes, and it is certainly what we need. While it might reflect a little bit upon him that I bring it up in this way, I do it because I am very much interested in his magazine. I am interested because it is what radiology needs, what we need as radiologists, and what the medical practitioner needs.

Another way that we can bring the knowledge of radiology before the general practitioner as well as before the general public is by radio broadcasting, and I think that this is a strictly legitimate way of doing it. A little of that was done in Chicago recently, and I have reason to believe resulted in some good.

We should read more papers before the state societies and the county societies. We should have more papers published in the state and national magazines.

Another very important thing along these lines is the holding of joint meetings, where there are local radiological societies in the larger centers. I mean joint meetings with your county society or your state society. These are bound to be of great educational value.

I want to compliment Dr. Swanberg on the presentation of his very timely paper.

DR. SWANBERG (closing): In answer to the question about duplication subscriptions for the educational publication I advocate, permit me to state that that is easily taken care of by the publishing house, for they will not accept duplicate subscriptions. If one physician is in the habit of referring his work to three or four radiologists and one radiologist enters a subscription for him and later another radiologist also subscribes for this same physician, the second subscription will not be accepted, for not more than one subscription will be accepted for any one doctor.

Inasmuch as the discussion of my paper has practically centered around the educational publication, which by the way is only one of the means to spread a greater appreciation of radiology, permit me to state that I have attempted to sense the feeling of the radiologic profession on this subject. I sent out a questionnaire to one hundred leading men in the profession and the great majority of replies received to date would signify that they are heartily in favor of such a publication.

Some have objected to such a journal because they state that there are too many radiological journals already, and an effort should be made to reduce rather than to increase their number. This argument has

little weight, for there is no other journal of this type. This is a new field of educational work and requires a new type of publication. It is impossible to appeal equally to the general practitioner and radiologist with one journal. Our present radiological journals, while splendid within their own scope, cannot be expected to appeal to practising physicians. Another argument advanced is that such a journal is to be condemned because it attempts to "force" radiology. However, such is not the case. No one is forcing anyone to read it. The radiologist can, in a very courteous way, call the attention of his physician-patrons to the fact that such a special educational publication in radiology for practising physicians does exist and can offer to send it to them if they would care to receive it. Surely there is nothing about "force" with such methods. Disinclination to hasten the progress of radiology and refusal to spread a knowledge of its usefulness is not in the spirit of the times. Other men have thought such a journal "too commercial." This is not so, for it is entirely educational. As one radiologist has put it, "It helps the men who see these conditions first." We are living in a very complex world and everything that we or anyone else does reacts to the advantage of someone.

**Radiation of the spleen.**—The effects of the application of radio-activity to the spleen are discussed under the headings of (1) relief of capillary hemorrhage; (2) increase in hemoglobin; (3) increase in red cells; (4) decrease in white blood cells; (5) stimulation of immune bodies; (6) effects on other organs.

In treating myelogenous leukemia the author noted the cessation of nose-bleeding after using radium over the spleen. He quotes Nagy and Nurnberger, who recommend the radiation of the spleen in any hemorrhagic condition.

Both hemoglobin and red cells were increased after using radium over the spleen in leukemia, also in one case of pernicious anemia.

The decrease in white cells is well known after radiation of the spleen, and in leukemia this reduction may be very marked.

The stimulation of immune bodies has been utilized by the author in two cases of abdominal tuberculosis with very excellent results, and there is a growing tendency to radiate the spleen by small doses as an adjuvant in the treatment of tuberculosis.

W. W. WATKINS, M.D.

*Some Probable Functions of the Spleen as Demonstrable by the Effects of Radio-activity upon that Organ.* Adolph Henriques. *New Orleans Med. and Surg. Jour.*, June, 1924, p. 534.

## CASE REPORT OF RECURRENCE OF VESICAL CALCULUS

By C. H. DEWITT, M.D., VALPARAISO, INDIANA

E. L., aged five years, was referred to me by R. D. Blount, M.D., on July 18, 1919, with a history of painful and difficult urination, a condition which had been present for several months.

The roentgenograph revealed a vesical calculus (Fig. 1). This was successfully removed by E. H. Powell, M.D., on the next

day, July 19. The calculus measured one and three-quarters by one and one-quarter inches.

Both calculi were composed chiefly of calcium oxalate, with some urates and phosphates.

The condition of the right hip as shown



Fig. 1.

day, July 19. The calculus measured one and three-quarters by one and one-quarter inches.

On November 21, 1924, the boy was again referred for X-ray examination. Fig-



Fig. 2.

ure 2 shows calculus present at this examination. On the following day Dr. Powell removed a stone that measured two and one-quarter by one and one-half inches.

Both calculi were composed chiefly of calcium oxalate, with some urates and phosphates.

The condition of the right hip as shown in Figure 2 is the result of osteomyelitis, following an empyema of the right pleural sac.



## ADVANCED TROUBLE SHOOTING

### SUGGESTIONS

By C. B. HORSLEY, PITTSBURGH, PENNSYLVANIA

**A** FEW suggestions at random may prove to be of benefit to some.

Even experienced doctors are often compelled to forego the use of their equipment for several days for no greater trouble than a "blown" fuse. Though in case of trouble the fuses are generally inspected, it often happens that a "blown" fuse is renewed by a fuse that is equally as "blown," and when this new fuse fails to help matters the doctor is completely puzzled. Great care should be taken to completely discard all burnt-out fuses. The use of a test lamp is the best manner in which to settle the question of fuses definitely.

Before calling for outside aid one should be sure that all the switches on the apparatus are in their proper positions. In most installations there are one or more switches generally left in one position permanently. The position of one of these switches is sometimes changed without the knowledge of the doctor or the technician. It even happens that, once it is changed, the operator is not able to tell in which position the switch should be for the proper operation of the apparatus. Trouble such as this might be forestalled if the future operator of the apparatus would insist upon a complete explanation of the function of all the control mechanism when the machine is installed. If the doctor in charge would but take the trouble to get at least a general idea of what happens at each step in the operation of his machine, instead of letting it go at "turning this and pushing that," besides the satisfaction in itself of knowing,

he would possibly save himself much future trouble.

The average installation requires little attention, but at least it should get this little attention regularly. The synchronous motor should be oiled regularly according to the instructions received with the apparatus. The attention required by these motors varies from oiling once a week for therapy installations where the apparatus is constantly used, to oiling or greasing but once every three months for more or less intermittently used radiographic units. The entire equipment, aerial, rectifying mechanism, and all, should be wiped off at regular intervals, depending upon the rapidity with which the dust collects. If too much dust is allowed to accumulate on the surface of an insulator, harm may be done the apparatus by a surface discharge. This applies especially to the tubes.

Remember that a loose connection is more likely to be the cause of variations in the milliamperage than an unstable line current.

Burnt-out meters should be returned to the factory for repairs unless more immediate use of the meter is essential. In attempting to repair a meter it should be set on a large piece of paper before being taken apart in order that all the parts may be found again. If great care is exercised in taking the meter apart and again in assembling it, the doctor may be successful in locating the trouble, generally a burnt wire or loose connection, and repairing his meter.

## RADIO-ACTIVE SUBSTANCES AND THEIR THERAPEUTIC USES AND APPLICATIONS

By JOSEPH MUIR, M.D., NEW YORK

### THE EMPLOYMENT OF BURIED RADIUM EMANATION

**T**HOUGH dosage and the proper distribution of the sources of radiation are important in any method of employing this therapy, in none are they of so great moment as when the method of buried emanation is under consideration. It is at once apparent that ideal conditions cannot obtain in all cases, or, to be exact, in any case, for the particular tissue or tumor which is to be treated will invariably present individual characteristics and peculiarities which cannot be absolutely subordinated to any fixed rules. All living things are subject to individual variations, and in the application of radium, an active substance, to human tissue, a living organism, we are confronted with a twofold problem.

We have already (in a previously published paper of this series) explained the method of preparing radium emanation tubes or "seeds." The problem confronting the clinician is the number of these tubes which he shall employ in a given case, and the several locations within the area of tissue to be irradiated where these tubes can be disposed to the greatest advantage. Where the greatest attention has been given to this particular form of radium therapy it has been found that complete retrogression of a tumor growth can be accomplished in the great majority of cases by a single treatment, and that such a result—if it can be accomplished—assures greater likelihood of halting the disease process at an early stage, as it gives no opportunity for further extension having its rise in remnants of diseased tissue, the destruction of which was not completely accomplished. Thus the selection of dosage and location for the initial treatment becomes a matter of paramount importance. The object to be attained is to destroy the neoplasm or

pathologic area completely, but at the same time to reduce the caustic action to the lowest possible minimum, while avoiding the production of extensive necrosis.

### NECROSIS DUE TO EMBEDDED "SEEDS"

It would be desirable, but is—because of the limitations of our present knowledge—unfortunately impossible, to eliminate all necrosis about the tubes used in deep implantations of radium emanation. At the Memorial Hospital, for example, no tube is used which contains more than 3 millicuries or less than 0.1, and it has been observed clinically, and substantiated by careful experimentation upon animals, that any of these tubes imbedded for periods varying within two months, will unfailingly produce an area of necrosis one centimeter in diameter,—this necrosis being due to the intense beta and soft gamma radiation which takes place in the immediate vicinity of the tube. Better success than this has, however, been attained at the Hahnemann Hospital in Philadelphia, where Dr. Frank Colgate J. Benson, a pioneer in the use of radium emanation "seeds," has so distributed the units of dosage, by employing minute quantities extensively implanted, as to succeed in reducing the area of necrosis about each individual capillary tube almost to the vanishing point. The remarkable skill and infinite scientific persistence of this investigator can be fully appreciated only by those who, like myself, have enjoyed the inestimable privilege of witnessing his gradual advance in this hitherto untried therapeutic field, and his triumph over obstacles calculated to turn aside even the most dauntless spirits. The fact that his success has never been blazoned abroad only emphasizes the value of his attainments in the eyes of those in a position to understand them.

## SIZE OF DOSE

Experiments upon both normal and neoplastic tissues were carried on some years ago by Bagge, with a view to determining the amount of buried radium emanation which could most safely and efficiently be employed. He reached the conclusion that the dosage then in use (1920) was larger than was necessary to bring about the best results. Since that period relatively smaller doses have been made use of, though the opinion is still held by many authorities that in the treatment of smaller growths, the scale of dosage advised by Bagge may very profitably be increased. Thus, we find as large an amount as five millicuries of radium emanation being applied for each centimeter of tumor tissue, this amount being distributed, however, as evenly as possible throughout the growth by the employment of a number of "seeds." If we have to deal with a larger neoplasm, 0.5 millicurie to each cubic centimeter of tumor tissue may be enough, if this brings the total amount of radium emanation employed up to from twenty-five to thirty millicuries. This is in accordance with the principles previously laid down, that relatively heavier dosage must be used in shallow surface areas than in penetrating growths which tend to preserve a spherical shape.

## ANALOGY BETWEEN PLANT AND ANIMAL TISSUE EXPOSED TO RADIUM EMANATION

The effects of buried radium emanation upon plant tissues, both normal and pathologic, have been studied and compared with the behavior of human and other animal tissues under analogous circumstances. In every instance, whether experimental or clinical, it has been observed that some two weeks after the tube of radium emanation is inserted in the neoplastic growth, the tissue closest to the tube is found in a state of complete necrosis, while beyond this necrotic area, cellular degeneration has taken place. Later, the necrosed area completely disappears, being absorbed and replaced by the formation of connective tissue. These

general results are practically constant. Five millicuries of radium emanation, distributed between ten "seeds," will cause the necrosis and absorption of 10 cm. of neoplastic tissue. In order to gain this effect by surface application of radium, either the element or the emanation, it would be necessary to make use of the gamma rays—obtained by filtration—from 500 millicuries of radium, varying the time of exposure in accordance with the individual requirements of the neoplasm under treatment—from ten to twenty hours. The statement made by physicists that the biologic effect of one millicurie of radium emanation buried in the tissues equals 132 millicurie hours of surface application of filtered rays, takes into account only the action of the *gamma rays*, and disregards altogether the effect of the beta rays and their secondary roentgen rays.

## COMPARISON OF DEEP DOSAGE WITH X-RAYS OR WITH GAMMA RAYS

The same effect may be produced by the gamma rays of radium emanation as that obtained by the use of X-rays, if sufficient radium emanation is available to give the required intensities. Moreover, it has been established that (1) for the same intensity at the surface, the intensity at any point below the surface is greater for the gamma rays, though the effect for X-rays down to 14 cm. depth is greater; that (2) given the same effect at the surface, the intensity and effect below are much greater for gamma than for X-rays.

The interest of these observations and conclusions lies in their bearing on the number of portals of entry required to convey the desired dosage of radiation to a point below the skin surface, and "the possibility of increasing the dose at points below the skin to a greater value than at the skin." It is the ratio of the deep dose to the surface dose that determines the number of portals of entry necessary. At a depth of 20 cm. two portals of entry will be sufficient for gamma rays, whereas fifteen would be necessary for X-rays capable

of producing the same intensities. This is, of course, assuming that the beams from both types of sources are parallel.

Both gamma rays and roentgen rays are light rays having wave lengths of very small size, and their effect upon an atom of matter which they may happen to enter is the same no matter which one is the active agent. A change in the atoms composing human tissue, whether it be normal or neoplastic, is effected by the entrance of such a ray. The gamma ray, penetrating the tissues, sets a number of electrons in motion, and these electrons, in their turn, are productive of secondary roentgen rays, so that other constituents of the tissues are affected in their turn. When we consider that beta rays are themselves electrons in motion, and that the beta rays of radium are products of the gamma rays of the same element, it is immediately apparent that their velocity equals that of the electrons which these gamma rays liberate in the tissue, and that they also must produce secondary roentgen rays which are analogous to those produced by the gamma rays. The difference between beta and gamma rays is, therefore, a quantitative one—their ratio in a given unit of radium or its emanation being relatively as one to one hundred; their biologic action should, therefore, be analogous.

#### MORE EXACT DOSAGE POSSIBLE BY THE RADIUM EMANATION IMPLANTATION METHOD

All these considerations emphasize the greater accuracy of dosage obtainable by the method of embedding tubes of radium emanation directly in the growth to be treated. The clinical results of this form of application were found by Levin and Levine to be "very significant." Neoplastic growths which were unaffected by large applications of filtered rays upon the sur-

face responded readily to the action of radium emanation embedded directly in the affected tissues. To those who have attained skill and accuracy in placing the radium emanation "seeds" and are equipped with the proper instruments for performing the work in the best manner possible, the method presents practically no difficulties, and the exactness with which dosage can be gauged and administered reduces the whole procedure to a scientific basis infinitely in advance of the decidedly empirical methods which the earlier workers were perforce obliged to employ. The even distribution of minute quantities of radium emanation throughout the growth to be treated, which brings the radio-active substance in intimate contact with the diseased tissue, yet, because of the minute quantity located in any one spot, does not exert a deleterious influence upon the organism as a whole, as is the case when the effect is more concentrated and powerful, is an immense advance over any method of employing radium for therapeutic purposes yet discovered by scientists.

It is hoped that further experimentation employing containers other than the glass capillary tubes which up to the present have proved most efficient for the intratumoral use, may make it possible to obtain still greater exactness by filtration, thus producing end-results equal to those now obtained with "bare" tubes, while obviating the production of necrosis, and relieving the patient of the systemic reaction which is oftentimes at present unavoidable.

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# DEPARTMENT OF RADIODONTIA

UNDER THE SUPERVISION OF BOYD S. GARDNER, D.D.S.,  
ROCHESTER, MINNESOTA

## THE RADIOGRAPHIC DIAGNOSIS OF PERIAPICAL DENTAL INFECTION IN THE LIGHT OF BACTERIOLOGIC FINDINGS<sup>1</sup>

By RUSSELL L. HADEN, M.D.

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THE dental radiograph is widely used as a means of detecting infection in the periapical tissues and alveolar process. Certain criteria, such as rarefaction or condensation of bone, changes in the peridental membrane and lamella, and absorption of root tip are taken as diagnostic of infection. What the physician or dentist interested in correlating systemic disease and dental infection really wishes to know is how many and what kind of bacteria are present in a given area or areas. Active infection necessitates the presence of bacteria, and only by reason of the presence of bacteria are pulpless teeth of importance from the standpoint of systemic disease. The radiographic criteria of infection, if dependable, must be a means of determining the presence or absence of bacteria in a suspected area.

Such considerations bring up the question of how far one can translate radiographic evidence of infection into terms of bacteria. Does the absence of radiographic evidence of infection rule out the presence of bacteria? Does the finding of certain radiographic evidence of infection always mean the presence of bacteria? The problem is entirely a bacteriologic one, yet it is surprising how slight dependable data are available concerning the bacteriologic status of the pulpless tooth. In fact there is not available in the literature a single comprehensive bacteriologic study of dental infec-

tion by modern methods. I have endeavored by cultures of pulpless teeth to obtain further facts concerning periapical dental infection.

Numerous difficulties enter into bacteriologic work about the teeth which are not encountered in similar work elsewhere. The chances of contamination are always great. If broth is used as the culture medium, one never knows just how to interpret positive results. One bacterium in a tube of liquid medium gives rise after twenty-four hours of incubation to as profuse a growth as if a large number were inoculated. Dependable data in this field then must give, first of all, some idea of the number of bacteria in the material cultured. It is imperative also that proper control be available by which the chances of contamination can be estimated numerically. A final requirement in a study such as this is use of a culture medium suitable for the growth of the bacteria dealt with here. The organisms found in chronic foci of infection are often difficult to cultivate. Rosenow has emphasized especially the need of employing a medium which supplies all gradations of oxygen tension between complete anaërobiosis and full atmospheric pressure. This is a fundamental requirement both for proper growth and for preserving during the incubation period the specific affinity of the organism for different types of tissue.

To meet these several requirements I have made all cultures in deep tubes of

<sup>1</sup>Read before the Radiological Society of North America, at Kansas City, December, 1924.

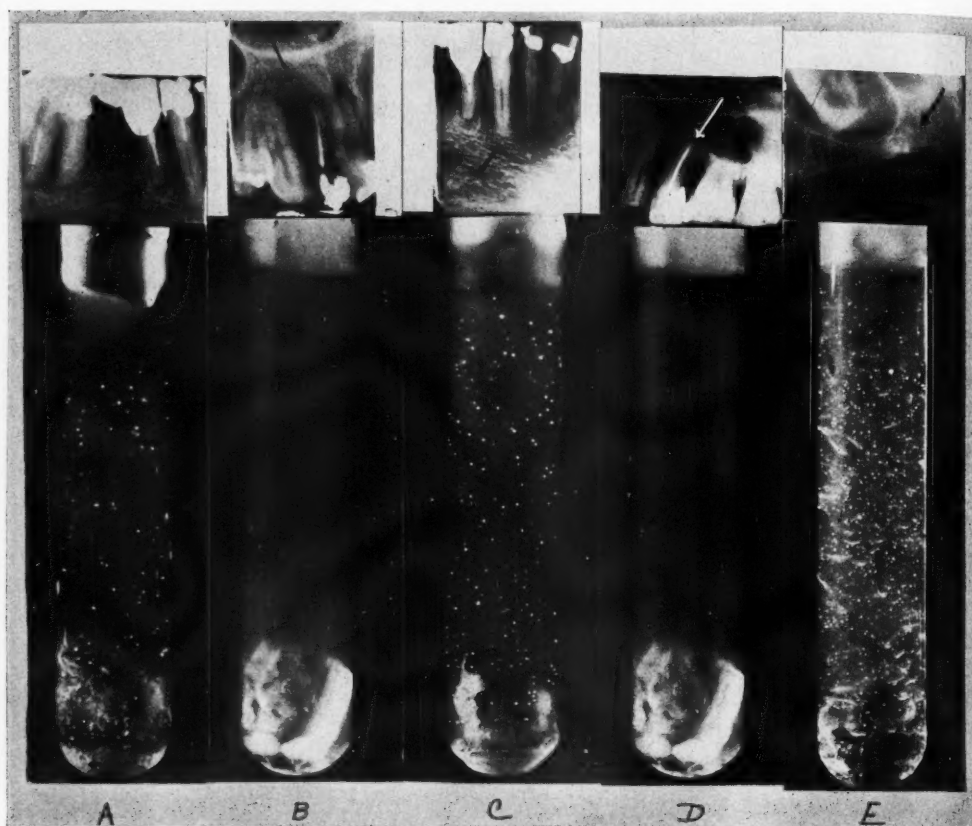


Fig. 1. Comparison of dental radiographs and bacteriologic cultures (the photograph immediately below the apex indicated by an arrow represents the original brain agar culture from the area so designated). *A*, positive radiograph, with culture showing profuse growth; *B*, positive radiograph, with culture showing no organ-

isms; *C*, negative radiograph, with culture showing a profuse growth; *D*, suspicious radiograph, with culture showing no growth; *E*, residual root with little radiographic evidence of infection but with culture showing a profuse growth of bacteria.

glucose brain agar. The tubes used are  $6 \times \frac{3}{4}$  inches and filled as close as possible to the top without allowing the medium to touch the cotton stopper. The exact details for preparation of the culture medium have been described elsewhere (1). The bottom of such a culture tube is almost completely anaërobic, the top is at full atmospheric tension, so between the bottom and top there are all gradations of oxygen tension or percentage. This glucose brain medium is almost a specific one for non-hemolytic streptococci. The agar also holds the colonies discrete so that the number present

may be counted. As a control on technic and to estimate numerically the chances of error a large number of vital teeth have been cultured during the same period the pulpless teeth have been cultured.

The technic used in obtaining the material is as follows: the teeth are first thoroughly scrubbed off with gauze, and the gums are painted with tincture of iodine followed by alcohol. The field of operation is packed off with a sterile gauze and the tooth extracted with a sterile forceps. The apex of the tooth is cut off with a sterile instrument directly into a sterile tube containing

about 1 c.c. of 0.85 per cent salt solution and a small amount of sand.

In making the culture the tube containing the root tip in the sterile sand and salt solution is well shaken to macerate the tissue on the tip of the tooth. The culture material is poured into a deep tube of glucose brain agar which has been heated and allowed to cool to 40° C. At the same time a tube of glucose brain broth is inoculated for use in studying the tube of organism and for animal inoculation if such is to be done. The inoculated tubes are incubated for 24 to 48 hours at 38° C.

In the statistics to be presented I have included the cultures of the incisors, cuspids and bicuspid only, since extraction of the molars without mouth contamination is often quite difficult. The different steps in the technic have been repeatedly checked bacteriologically to detect possible errors.

The results of the cultures of 1,307 teeth made in the manner outlined are shown in Table I. I have not included in the series any cultures in which there was a question of contamination from saliva, lips, tongue or otherwise at time of extraction. Likewise I have excluded teeth showing pyorrhea. The teeth cultured are fairly equally divided between vital teeth, pulpless teeth with negative radiograph, and pulpless teeth with positive radiograph.

Three hundred ninety-two vital teeth have been cultured. Of these 14 per cent have shown one or more colonies, 5 per cent ten or more colonies in a deep tube, and 1 per cent have had over one hundred colonies. These results indicate the percentage of error which must be allowed for in interpreting the results in pulpless teeth. The positive cultures do not all represent, however, errors in technic. Some of the teeth considered as vital were probably pulpless, since all were not tested for vitality and others had large cavities and might well have already had infected pulps. Forty-six per cent of the broth cultures from these teeth were sterile.

Four hundred twenty-five pulpless teeth with positive radiograph are included. Of

these, 70 per cent showed one or more colonies in the deep agar tube, 60 per cent ten or more colonies and 44 per cent over one hundred colonies in the deep tube. Nine per cent of the broth cultures in this group were sterile. The significant findings here are that 40 per cent of the teeth with positive radiographic evidence of infection showed less than ten colonies and 9 per cent were sterile in broth. It is evident that in many cases the infection had run its course and healing had taken place so far as the presence of bacteria is concerned.

Four hundred ninety pulpless teeth with negative radiograph have been cultured. Fifty-four per cent of these have had one or more colonies in the deep agar tube, 44 per cent ten or more colonies and 24 per cent over one hundred colonies. Eighteen per cent were sterile in broth. I realize that there may be much discussion and difference of opinion concerning what radiographic criteria should be employed in placing teeth in this group. I have taken a conservative attitude as to what is positive or negative. The striking thing here is the high percentage of positive cultures. The incidence of infection is almost as high as in those with a positive radiograph.

The organisms recovered have been streptococci in pure culture or mixed with staphylococci. Only rarely have other organisms been encountered.

I should like to emphasize that these cultures so made show only the bacteriologic status of the tooth at the time the culture is taken. It tells nothing as to what was there yesterday, or would have been present thereafter. It must also be granted that some of the negative cultures might have been positive if cultured in other ways, although the mediums used are the most favorable known for the growth of non-hemolytic streptococci. Several times during the past two years I have summarized the results of the cultures over different periods of time. The percentages, however, have remained almost constant.

The results of this study afford some concrete idea of the frequency of infection in

TABLE I  
RESULTS OF QUANTITATIVE CULTURES FROM  
PERIAPICAL DENTAL INFECTION

Group	Number Cultured	Number Showing in Deep Agar Tube			Number Sterile in Broth
		1 or more Colonies	10 or more Colonies	Over 100 Colonies	
Vital teeth	392	14%	5%	1%	46%
Pulpless teeth with negative radiograph	490	54%	44%	24%	18%
Pulpless teeth with positive radiograph	425	70%	60%	44%	9%
All pulpless teeth	915	61%	51%	33%	14%
Total	1,307				

periapical tissue as compared with the radiographic findings. Some idea of the number of bacteria is also obtained. The results show beyond question that there is a sharp limitation to the translation of radiographic evidence of infection into true infection, i.e., the actual presence of bacteria. The percentage of positive cultures in those teeth which show radiographic evidence of infection is so high that such evidence is sufficient to warrant radical measures. However, the absence of radiographic evidence of infection should never be taken as sufficient to exclude the possibility of an active dental infection. In such cases the status of the patient must be taken into consideration, and the question of the presence and severity of lesions of focal origin be taken into consideration. Given a patient with serious disease of focal origin in which the removal of all possible foci is indicated, the extraction of all pulpless teeth should be given the most serious consideration. One can reach no other conclusion in the light of the high percentage of positive cultures obtained from pulpless teeth which are radiographically negative for infection.

In this connection one final point should be emphasized. The changes, which from the X-ray standpoint are usually considered as indicative of infection, are all, in fact, evidence of the body resistance to the infection. In cases of systemic disease arising from chronic foci the very existence of the systemic lesion is in itself an evidence of a lack of resistance to the focal lesion. It is apparent that in such cases there will be little local evidence of resistance to infection. It is logical also to assume that the infected pulpless tooth which shows evidence of infection is a far greater source of danger than the one which does show definite radiographic evidence.

#### SUMMARY AND CONCLUSIONS

Cultures have been made of the periapical tissue of 1,307 vital and pulpless teeth, and the findings compared with the radiographs.

The technic employed affords: (1) proper controls to determine the chance of error; (2) a medium which is exceedingly favorable for the growth of the organisms



usually encountered, and (3) a means of measuring the extent of infection by determining the number of bacteria in the tissue cultured.

Of 392 vital teeth 9 per cent showed from one to ten colonies in a deep agar tube, 5 per cent ten or more colonies, and only 1 per cent over one hundred colonies.

Ten per cent of 490 pulpless teeth negative in the radiograph showed from one to ten colonies, 44 per cent had ten or more, and 24 per cent had over one hundred colonies.

Of 425 pulpless teeth with positive radiograph 10 per cent showed from one to ten colonies, 60 per cent had ten or more colonies, and 44 per cent had over one hundred colonies.

**The place of surgery in treatment of uterine cancer.**—(NOTE:—This article gives the viewpoint of a group of surgeons, a group which is growing less each day, but still exists.—W. W. W.)

Surgical results in cancer of the uterus are satisfactory. There must be early diagnosis and extensive operation. Graves now operates on 50 per cent, Wertheim 61 per cent and Bumm 90 per cent. As soon as diagnosis of cancer is made, operate, and operate thoroughly. When operations are done as are those of Wertheim we will not have to accept radium and X-ray as superior. They may yet develop a superiority over surgery, but have not yet done so. Radium and X-ray are valuable as follow-up measures, and every case operated on should have deep X-ray treatments. At present radium and X-ray do not compare well with surgery.

W. W. WATKINS, M.D.

*Surgical Treatment of Cancer of the Uterus.*  
L. M. Sackett. *Jour. Okla. St. Med. Assn.*, Aug., 1924, p. 196.

**Foci of infection.**—In a recent study of 1,512 patients, it was noted that often discouragingly poor results followed abdominal operations even when the best post-operative medical care was given; that in the past three years much more

The incidence of infection is almost as high in the radiographic negative group as in the radiographic positive group. There is a very sharp limitation to the translation of radiographic evidence of infection into terms of bacteria.

The absence of radiographic evidence of infection at the apex of a pulpless tooth never excludes the presence of active infection.

In many cases the radiographic negative tooth is a far greater source of systemic infection than the radiographic positive tooth, since in the former there may be little resistance to the infection.

#### REFERENCE

1. HADEN, R. L.: *Arch. Int. Med.*, 1924, XXXII, 823.

satisfactory results were secured in similar patients in whom all obvious foci, oral or otherwise, were removed prior to operation; that a rapidly growing group of patients with classical symptoms of ulcer, cholecystitis, gastro-enteritis and colitis have been cured by surgical removal of foci of infection, without abdominal operation.

While this paper emphasizes dental infection, it is necessary that a complete survey for all possible foci be made, particularly the tonsils and the sinuses of the head. It is necessary to have a complete X-ray study of all the teeth, and suspicious teeth which are not extracted should be watched by X-ray examinations every six months.

Absence of pain is a characteristic of streptococcus infection about the teeth, though discomfort is usually present; there is also frequently a peculiar metallic taste.

A series of 72 cases is tabulated, showing the effects upon gastro-intestinal disorders of attention to foci of infection, especially about the teeth.

W. W. WATKINS, M.D.

*The Effects of Removal of Dental Infection on Chronic Gastro-intestinal Disorders.* G. Reese Satterlee. *Med. Jour. and Rec.*, May 21, 1924, p. 481.

# EDITORIAL

M. J. HUBENY, M.D. . . . . Editor  
EDWARD W. ROWE, M.D. } Associate Editors  
BENJAMIN H. ORNDOFF, M.D. }

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## RADIOGRAPHY OF THE SELLA TURCICA

The present interest in endocrine disorders and the apparent increasing frequency with which the roentgenologist is called upon to assist in the diagnosis of these conditions have caused the roentgen demonstration and interpretation of changes in the sella turcica to become of considerable importance. The value, however, of the roentgen interpretation in these cases is dependent on a knowledge of the normal structure as revealed not only by roentgenologic studies on normal individuals, but on actual anatomic specimens as well. Unfortunately, the latter prerequisite was underestimated by early workers and as a result there have arisen certain conclusions which cannot be substantiated by anatomic facts.

I refer particularly to the so-called "bridged sella," which has been cited from time to time as a cause for diabetes insipidus, epilepsy, and migraine. This anatomic variation, which consists of a bony union between the anterior and posterior clinoid processes with occasional inclusion of the middle clinoid process, occurs in about 5 per cent of necropsy specimens. When the relation of the anterior clinoid processes to the pituitary fossa is considered and especially the fact that they always pass lateral to this fossa and never over it, the theory of a union between the anterior and posterior clinoid processes producing pressure on the hypophysis, infundibulum or associated blood vessels, seems quite improbable. Roentgenograms

of this anatomic variation are quite misleading, as the shadow of the bony union which is in reality just lateral to the pituitary fossa is cast over the outlet of the sella and seems to enclose it and diminish its size.

Aside from existing as an anatomic possibility, the appearance of a bridged sella may be produced on the roentgenogram by the superimposition of the shadows of the anterior and posterior clinoid processes. This may occur when the sagittal plane of the head is not placed parallel with the film, or when the tube is incorrectly centered. An incorrect lateral position not only distorts the images of the clinoid processes but the contour of the sella as well, and under such conditions the pituitary fossa may appear unusually small or shallow. These are not uncommon faults of roentgenograms of this region and many of the so-called bridged sellæ are not true anatomic variations but artifacts due to technical errors.

The intimate relation of the sella turcica to the pituitary gland is no doubt responsible for the erroneous idea that all changes in its contour are the result of pituitary disease. It is true, with certain exceptions, that pituitary tumors produce changes in the contour rather characteristic in type, but there are so many other causes of sellar deformities that failure to bear them in mind may result in an erroneous diagnosis with subsequent disappointment for the surgeon and perhaps disaster for the patient.

From the roentgenologic standpoint, the pathologic conditions producing deformities of the sella may be classified as follows: (1) Intracellular tumors involving the pituitary; (2) intracranial diseases producing a chronic increase of intracranial pressure; (3) disease of the sphenoid bone. Generally speaking, a tumor originating

within the pituitary fossa produces a deformity of the sella which is characterized by (1) uniform circular enlargement; (2) erosion and thinning of the dorsum sellæ; (3) blunting of the anterior clinoid processes; (4) erosion and destruction of the floor; (5) absence of intracranial pressure changes in other parts of the skull, except in advanced cases. In contradistinction to this, the pressure associated with extrasellar tumors or chronic increased pressure produces a widened and flattened sella. Since the pressure is transmitted solely from above, the posterior clinoids are eroded from above and become shortened and pointed rather than narrowed and thinned. The anterior clinoid processes are thinned and pointed rather than shortened and blunted. As the anterior wall and tuberculum sellæ are eroded from above, the outlet of the fossa becomes widened and the depth is diminished rather than increased.

The importance of recognizing early pathologic changes in the roentgenogram is obvious. However, in view of the numerous variations found in the normal sella, particularly as regards the shape and size of the fossa and clinoid processes, conservatism and caution should be used in interpreting suspected early changes in this structure.

J. D. CAMP, M.D.

## INTERNATIONAL CONGRESS OF RADIOLOGY

*Preliminary Meeting, London,  
July 1-4, 1925*

President of Congress: C. Thurstan Holland, D.L., Ch.M. President of Roentgen Society: Alfred E. Barclay, M.A., M.D. President of Electro-therapeutic Section of Royal Society of Medicine: Stanley Melville, M.D. President of British Institute of Radiology: Sir Humphry Rolleston, Bt., K.C.B., M.D., D.C.L., LL.D. Treasurer:

James Metcalfe, M.D. Secretary-General: Stanley Melville, M.D.

Organizing Committee: Chairman, Robert Knox, M.D.; G. B. Batten, M.D.; E. Beverley Bird, M.R.C.S., L.R.C.P.; E. P. Cumberbatch, M.A., M.R.C.P.; N. S. Finzi, M.B.; W. Hope Fowler, M.B., F.R.C.S.; F. Hernaman-Johnson, M.D.; G. W. C. Kaye, M.A., D.Sc.; G. Harrison Orton, M.A., M.D.; E. A. Owen, M.A., D.Sc.; J. Magnus Redding, F.R.C.S.; Russell J. Reynolds, M.B.; J. B. Mennell, M.D.; J. M. W. Morison, M.D.; J. R. Riddell, F.R.F.P.S.; R. W. A. Salmond, M.D.; F. Shillington Scales, M.A., M.D.; H. B. Scargill, M.B.; S. Gilbert Scott, M.R.C.S., L.R.C.P.; G. E. Thornton, M.A., M.B.; W. J. Turrell, M.A., M.D.; J. H. Douglas Webster, M.D.; J. E. A. Lynham, M.D., M.R.C.P., and John Muir, B.Sc., M.B., Ch.B., Joint Secretaries.

### MEMORANDUM OF ARRANGEMENTS

The Organizing Committee has pleasure in announcing that it has been decided to hold a Congress of Radiology in London in July, 1925. The arrangements are being made jointly by the Electro-therapeutic Section of the Royal Society of Medicine, the Roentgen Society, and the British Institute of Radiology.

The Congress will be of an international character inasmuch as radiologists from every country are invited to take part. Its objects are to bring together radiologists from all parts of the world to discuss subjects of interest, and to secure the formation of a comprehensive International Committee and the establishment of a full International Congress to be held at stated intervals in different countries. It is hoped that at this London Congress arrangements will be made for the First International Congress, and that the date, and the country in which it will be held, will be decided upon by the International Committee.

Physics, electro-therapeutics and allied subjects will be included in the scope of the Congress.

*Societies.*—Radiological and electro-therapeutic societies are invited to send approved representatives who shall be eligible to serve on the International Committee. Societies are requested to bring the Congress to the notice of their members and to secure the attendance of as many as possible.

*Exhibitions.*—In connection with the Congress there will be an exhibition of radiological and electrical apparatus. The exhibition will be open during the four days of the Congress, and there will be an official visit to the exhibition. Firms wishing to exhibit should apply for particulars. There will also be an exhibition of radiograms in which dental radiograms will be included.

*Date.*—The opening meeting of the Congress will take place on the morning of Wednesday, July 1, 1925, and the other sessions will extend over that and the following days, ending on Saturday, July 4. In the following week arrangements will be made for visits to other centers of interest.

On the evening of Tuesday, June 30th, a reception will be held so that delegates and members may have an opportunity of meeting before the opening of the Congress.

*Papers.*—All papers intended to be read at the Congress must be sent to the Secretary General, at the British Institute of Radiology, not later than May 1st, accompanied by a short abstract. *It is particularly desirable that papers should, wherever possible, be approved by a recognized society of which the author is a member.* All papers and abstracts must be typewritten or printed, and English translations will be much appreciated. Authors will be notified of acceptance or otherwise of their papers as soon as possible after their receipt. Each paper read at the Congress will be in the language selected by the author. It is intended to publish papers read at the Congress in the *British Journal of Radiology*.

*Membership.*—*It is hoped that all who wish to attend the Congress will signify their intention as soon as possible so that some estimate may be made of the numbers*

*attending. The fee for membership of the Congress will be two guineas (£2 2 0).*

*Travel and Accommodation.*—Arrangements are being made through an agency for travelling facilities and hotel accommodation. Particulars will be sent on application to the Secretaries. Further particulars will be announced in due course, and the fullest possible information will be given to those applying. Correspondence and suggestions on any matter in connection with the Congress are cordially invited.

*Address.*—The house of the British Institute of Radiology will be used as the administrative center for the Congress. An information bureau, with interpreters, will be provided. All communication should be addressed to THE SECRETARIES, INTERNATIONAL CONGRESS OF RADIOLOGY, c/o THE BRITISH INSTITUTE OF RADIOLOGY, 32 Welbeck Street, London, W.1.

Telephone: Mayfair 3273; Telegraphic Address: BRITOLGY, Wesdo, London; Cable Address: BRITOLGY, London.

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#### RULES AND REGULATIONS FOR APPROVAL OF CLINICO-PATHOLOGICAL AND X-RAY LABORATORIES

The purpose is to conform to the following ruling of the Comitia Minora of the County Medical Society: "As a matter of public policy it is recommended to the profession that their support of commercial laboratories be withdrawn, and wherever possible, patients be referred to laboratories under supervision of competent and qualified medical men."

1. The New York County Medical Society will grant to the Director of such laboratories as comply with the following requirements, a certificate of approval so that the medical profession, and through them the public, may have a guarantee of expert laboratory service.

2. The approval may be published but it must show that the medical director for



either the clinico-pathological or X-ray laboratory, or both, has his certificate for each.

3. The Director of the laboratory applying for a certificate shall submit the evidence of approval of his laboratory issued by the New York State and New York City Departments of Health, and shall undertake to comply with all state and city regulations.

4. The Director of each laboratory must be a licensed physician. The Director or his assistant, who must be a qualified licensed physician, shall make all clinico-pathological and X-ray interpretations or diagnoses of the laboratory, and shall sign such reports.

5. Each Director shall have had adequate hospital experience in his specialty.

6. The Director's name shall always appear on all printed matter, such as fee schedules, advertisements to the profession, and reports.

7. All information printed, or about to be printed, shall be submitted when making application for approval. All cards or advertisements shall be limited to strictly medical publications; a copy of each shall be sent to the County Medical Society.

8. The laboratory shall not give a discount, rebate, commission, bonus, or make any other division of fees.

9. The laboratory shall not advertise a consulting staff unless each consulting member actually or actively works for the laboratory.

10. A Director's certificate may be granted and revoked at the pleasure of the New York County Medical Society.

11. The County Medical Society may publish a list of the approved laboratories as they occur.

All who are interested in the subject should communicate directly with the County Society.

DANIEL S. DOUGHERTY, M.D., Sec.

17 West 43rd Street, New York.

# APPLICATION FOR CERTIFICATE OF APPROVAL OF CLINICO-PATHOLOGICAL AND X-RAY LABORATORIES

(Fill out in duplicate and keep a copy for your own files.)

No. .... Date ....., 192...

I hereby apply for approval as Director of a

- (a) Clinico-pathological  
or Laboratory  
X-ray (indicate which)
- (b) Name of laboratory
- (c) Address Telephone
- (d) If incorporated, when and where?
- (e) Names of the owners of at least a majority of the stock
- (f) Name of the Director
- (g) Address of Director Telephone
- (h) Age
- (i) Education, chronologically in detail:
- (j) Experience, hospital and clinical, chronologically in detail:
- (k) Date of New York license
- (l) Date of registration of license in New York County
- (m) New York State Department of Health Registry for laboratory No.
- (n) New York City Department of Health Permit for laboratory No.
- (o) Do you agree to comply with the following requirements of the Medical Society of the County of New York:
  1. That all clinico-pathological or X-ray interpretations and diagnoses will be made by the Director or by an assistant who must be registered and licensed to practice medicine in New York County.  
Ans.
  2. That all cards, advertisements, or fee schedules will be limited to strictly medical publications, and that a copy of each will be sent to the Medical Society.  
Ans.
  3. That the laboratory will not give a discount, rebate, commission, or make any division of fees. Ans.
  4. That the laboratory will not advertise a consulting staff unless

each consulting member actually or actively works for the laboratory.

Ans.

5. That the Director's name will appear always on all printed matter, such as fee schedules, advertisements to the profession, and reports.

Ans.

It is understood and agreed that a Director's certificate may be granted or revoked, with or without cause, at the pleasure of the Medical Society of the County of New York.

Ans.

Signed.....

NOTE: Please send all information printed or about to be printed, fee schedules and cards with this application to DANIEL S. DOUGHERTY, M.D., *Secretary*, 17 West 43rd Street, New York.

#### INTERESTING X-RAY FILMS FOR THE SOCIETY

Dr. Charles G. Sutherland, at the annual meeting in Kansas City, discussed with various members and officers of the Society and brought before the Executive Session the suggestion that the Society should establish a library of interesting X-ray films and invite all the members to contribute to this library any films or plates showing findings of rare or unusual interest.

The plan suggested was that reproductions would be made from the originals contributed and the originals returned to the contributor. These reproductions would be of a standard size mounted on mats of convenient size for exhibit purposes and accompanied by a brief but comprehensive legend. To expedite the carrying out of this plan Dr. Sutherland was appointed Librarian of the Society and has commenced work on the details involved.

Dr. Stevens requested a loan exhibit from the Society for the cancer week of the Wayne County Medical Society in Detroit in February, and through the courtesy of Dr. Carman and the Executive Board of the Mayo Clinic the facilities of

this institution were offered to the Society that this request might be met. The same facilities will be available to the Society until the library is firmly established and the details of its establishment thoroughly worked out. Such a plan will insure a larger and more interesting annual exhibit, as all cases contributed during the year will be placed in the annual exhibit. The Society can co-operate more closely with county and state medical and surgical societies by offering loan exhibits for their meetings when these would be of value. It has been suggested that the Society send a loan exhibit to the International Congress on Radiology in London this coming summer.

The Society Librarian could arrange to send unusual cases to a limited number of men of wide experience and have them record their opinions, should any member desire such service.

Many other details will have to be considered as they present in the working out of the plan; these will be submitted to the Executive Committee at the annual meeting.

In the meantime every member of the Society is requested to send films or plates to Dr. Charles G. Sutherland, P. O. Box 184, Rochester, Minnesota, accompanied by a brief but comprehensive history. Each film or plate should be labelled with the name and return address of the sender and films should be sent flat, *not rolled*. The earnest co-operation of every member in this new feature of the Society is necessary for its success; such co-operation may lay the foundation of an institution that will be of inestimable value to the profession of the future.

#### RESERVATIONS AT ATLANTIC CITY

The Chalfonte-Haddon Hall has been selected as headquarters for the Mid-annual Meeting, May 21, 22 and 23, 1925.

The hotel has a capacity of over 1,000, a meeting room which seats comfortably over 600, with good ventilation and acoustics, also a large room for exhibits.

The Management has made the following rates for the Radiological Society of North America:

Room with running water, one person . . . . .	\$6 to \$8 per day
Room with running water, two persons . . . . .	\$10 to \$12 per day
Room with bath, one person . . . . .	\$10 to \$12 per day
Room with bath, two persons . . . . .	\$14 to \$20 per day

The Hotel Management earnestly requests the members, when making their reservations, to state the length of time they wish their rooms.

The Local Chairman suggests that reservations be made early, as the Radium Society will meet in the same hotel the early part of the week following the Radiological Society.

W. C. WESCOTT, M.D.,  
*Local Chairman of Committee  
of Arrangements.*

## THE ATLANTIC CITY MEETING

### TIPS TO TRAVELERS

A one and one-half fare rate has been granted to those attending the meetings of the Radiological Society of North America and the American Medical Association at Atlantic City, next May, on the usual certificate plan.

Be sure to secure certificate when buying ticket to Atlantic City. Deposit it for validation as soon as you reach the meeting and call for it before leaving, so as to be able to secure the half-fare rate returning. After being validated these certificates are good for one-half fare to point of purchase. Ask your local ticket agent for further particulars.

### RADIOLOGICAL SPECIAL TRAIN FOR ATLANTIC CITY

Members, visitors, exhibitors, and others expecting to attend the Atlantic City meeting *via* Chicago will be glad to learn that the usual Radiological Special train will be on duty. Arrangements are in progress for an

all-steel through-sleeper train, Chicago to Atlantic City, *via* the Pennsylvania Lines, leaving Chicago at 11:30 P. M., Wednesday evening, May 20th, and arriving at Atlantic City, Thursday evening.

Stops will not be as frequent as on regular trains, thus affording a better night's rest. Suitable stops for passengers to board train or for attachment of coaches will be made at Fort Wayne, Pittsburgh, Harrisburg, and such other points as may seem desirable. Those living along the route of the Pennsylvania, in Indiana, Illinois, Michigan, Ohio, Pennsylvania, and Maryland, will be able to reach the special train on regular trains and may have all the advantages of our special.

There will be no excess fare on the Radiological Special, although we will travel as fast and with greater comfort than the excess fare trains.

The train will consist of the latest type open section, compartment, drawing room sleeping cars, club and observation car and dining car service, serving special breakfast, luncheon, and dinner en route.

Special cars will leave Detroit, Cleveland, Cincinnati, Louisville, and Indianapolis, according to schedule shown below, and be attached to the Radiological Special at Pittsburgh.

Lv. Chicago (Union Station), P. R. R.	
	11:30 P. M., C. T., May 20
Ar. Ft. Wayne, P. R. R.	
	2:45 A. M., C. T., May 21
Ar. Pittsburgh, P. R. R.	
	11:45 A. M., E. T., May 21
Lv. Detroit, P. R. R.	
	12:00 P. M., E. T., May 20
Ar. Pittsburgh, P. R. R.	
	8:50 A. M., E. T., May 20
Lv. Cleveland, P. R. R.	
	8:00 A. M., E. T., May 21
Ar. Pittsburgh, P. R. R.	
	11:30 A. M., E. T., May 21
Lv. Cincinnati, P. R. R.	
	10:55 P. M., C. T., May 20
Ar. Pittsburgh, P. R. R.	
	9:10 A. M., E. T., May 21

Lv. Louisville, P. R. R.

7:35 P. M., C. T., May 20

Ar. Indianapolis, P. R. R.

11:00 P. M., C. T., May 20

Ar. Pittsburgh, P. R. R.

10:00 A. M., E. T., May 21

Lv. Pittsburgh, P. R. R.

12:00 N., E. T., May 21

Ar. Atlantic City, P. R. R.

9:30 P. M., E. T., May 21

The regular one-way fares from various points to Atlantic City are as follows:

From	To Atlantic City
Louisville .....	\$30.14
Indianapolis .....	28.02
Cincinnati .....	25.83
Detroit .....	25.29
Grand Rapids .....	29.19
Chicago .....	31.52
St. Louis, via Chicago.....	36.88
Cleveland .....	19.37

Following are the Pullman fares from points indicated to Atlantic City:

———To Atlantic City———				
From	Lower	Upper	Compt.	Drawing-room
Louisville ..	\$9.00	\$7.20	\$25.50	\$31.50
Indianapolis	9.00	7.20	25.50	31.50
Cincinnati .	7.50	6.00	21.00	27.00
Detroit ....	6.38	5.10	18.00	22.50
Ft. Wayne..	7.50	6.00	21.00	27.00
Columbus ..	6.38	5.10	18.00	22.50
Chicago ...	9.00	7.20	25.50	31.50

Tickets reading from points referred to, to Atlantic City, are honored *via* direct line and Harrisburg, or by way of Washington and Baltimore, without additional charge, on either the going or return journey.

Members desiring to visit New York during the meetings or after their close may make a side-trip from Philadelphia at cost of \$6.48 for the round-trip.

Leaving Pittsburgh at noon the special train will travel through the heart of Pennsylvania's best mountain and valley scenery, presenting an ever-changing picture, brilliant in all shades of Nature, up one river to its source high on the mountain; down the

steep eastward slope of the Alleghanies and through the tortuous course of another river as it winds to the sea. To the east of Pittsburgh the road enters the Packsaddle, a deep gorge of the Conemaugh River; a few miles farther east, turning the western side of Laurel Hill, one comes to Sang Holow, heavily timbered to the water's edge, through which the Conemaugh runs in an exaggerated horseshoe curve shape. Then the railroad passes Allegrippus Knobs and the far-famed Horse Shoe Curve. No more beautiful view of mountain and valley is obtained in the United States than from this Horse Shoe Curve. Passing through the Valley of the Little Juniata River, Warrior Ridge Gap, Jack's Narrows, Lewiston Narrows, Gaps of the Susquehanna, we cross the Rockville Bridge, the longest stone arch bridge in the world, arriving at Harrisburg, the capital of Pennsylvania, a short time later.

In the latter part of May, when we make this trip, all of this scenery will be newly clothed in spring garments and it should certainly present a very appealing picture.

I. S. TROSTLER, M.D.,

*Mgr. of Exhibits and Transportation.*

## AMERICAN MEDICAL ASSOCIATION

Radiology has been given three sessions in the Section on Miscellaneous Topics at the meeting of the American Medical Association, which is to be held at Atlantic City, May 25-29, inclusive.

The sessions on Radiology will be held on the Pier, on the afternoons of May 27, 28 and 29.

This is an opportunity for Radiology to intrench itself permanently in the activities of the Association.

A large attendance is desirable, and when you register be sure to write in the word "Radiology."

## PROGRAM

Presidential Address:

P. M. Hickey, M.D., University of Michigan, Ann Arbor, Michigan



## Title to be announced later:

A. E. Barclay, M.D., Manchester, England

## Symposium on Peptic Ulcer:

## Pre-operative Radiological Findings:

Russell D. Carman, M.D., Rochester, Minnesota

## Post-operative Radiological Findings:

James T. Case, M.D., Battle Creek, Michigan

## Pathology:

Howard T. Karsner, M.D., Western Reserve University, Cleveland, Ohio

## Surgical Treatment:

Hugh Cabot, M.D., University of Michigan, Ann Arbor, Michigan

## Medical Treatment:

Lewellys F. Barker, M.D., Baltimore, Maryland

## Some Clinical Symptoms Indicating a Pyelographic Study of the Upper Genitourinary Tract:

Bernard H. Nichols, M.D., Cleveland, Ohio

## A Radiological Retrospect:

Albert Soiland, M.D., Los Angeles, California

## X-ray Treatment in Bronchial Asthma and Chronic Bronchitis:

I. Gerber, M.D., Providence, Rhode Island

## The Results of Radium Therapy for Recurrent Carcinoma of the Breast:

Burton J. Lee, M.D., and Norman E. Tannenbaum, M.D., New York

## Title to be announced later:

F. W. Hartman, M.D., A. Bolliger, M.D., and Howard P. Doub, M.D., Henry Ford Hospital, Detroit, Michigan

## Clinical and Roentgenological Consideration of Thymus Enlargement, and the Treatment of Its Hyperfunction:

Lawrence R. De Buys, M.D., and Ernest Charles Samuel, M.D., New Orleans, Louisiana

## Differential Diagnosis of Mediastinal Tumors:

William A. Evans, M.D., Detroit, Michigan

## The Roentgen Ray in the Treatment of Local Inflammations, Cellulitis, and Carbuncles:

Fred M. Hodges, M.D., Richmond, Virginia

## The Control of Non-malignant Uterine Hemorrhage by Radiation:

W. S. Newcomet, M.D., Philadelphia, Pennsylvania

## Roentgen Diagnosis and Treatment of Thymoma:

Thomas A. Groover, M.D., Washington, D. C.

## The X-ray Examination of Sinuses and Mastoids in Children:

E. H. Skinner, M.D., Kansas City, Missouri

## The Sella Turcica and the Significance of Changes in Its Radiographic Appearance:

John D. Camp, M.D., Boston, Massachusetts

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MEETING OF THE ROENTGEN RAY  
SOCIETY OF CENTRAL PENN-  
SYLVANIA

WILLIAM PENN HOTEL, PITTSBURGH, PA.

*April 25, 1925*

9:00 A. M.—Radiation in the Treatment of Non-malignant Skin Lesions. H. A. McMurray, M.D., Greensburg, Pa.

9:30 A. M.—The Treatment of Tonsils by Radiation. Byron H. Jackson, M.D., Scranton, Pa.

10:00 A. M.—Radiation in Hyperthyroidism. F. L. Schumacker, M.D., Pittsburgh, Pa.

10:30 A. M.—X-ray *versus* Radium in the Treatment of Enlarged Thymus. Homer Grimm, M.D., Pittsburgh, Pa.

11:00 A. M.—Treatment of Tuberculous Adenitis by Radiation. H. M. Stewart, M.D., Johnstown, Pa.

- 1:00 P. M.—Business Meeting.
- 2:00 P. M.—Superficial Malignancies. G. D. Bliss, M.D., Altoona, Pa.
- 2:30 P. M.—Observations on the Treatment of Neoplasms of the Stomach by Radiation. Zoe A. Johnston, M.D., Pittsburgh, Pa.
- 3:00 P. M.—Carcinoma of the Esophagus; Differential Diagnosis and Treatment. C. N. Schaefer, M.D., Pittsburgh, Pa.
- 3:30 P. M.—Some Roentgenological Aspects of Duodenal Ulcer. John F. McCullough, M.D., Pittsburgh, Pa.
- 4:00 P. M.—Some Lesions of the Colon as Seen by the Roentgenologist. William B. Ray, M.D., Pittsburgh, Pa.
- 4:30 P. M.—Presentation of Moving Picture Film of Dr. Lewis Gregory Cole, "Motor Phenomena of the Stomach."

#### COMMUNICATION FROM DR. ALBERT SOILAND

TO THE EDITOR: The article in the January number of RADIOLOGY, under the heading "Correspondence," entitled "Excision of a V-shaped Piece of the Lower Lip versus Roentgen-ray or Radium Treatment," by Dr. Joseph Colt Bloodgood, elicits my attention and interest.

I assume that your purpose in re-printing this article now is to provoke discussions of this topic. At the time the article appeared in the *Journal of the American Medical Association*, I wrote a reply defending the position of the radiologists against this criticism of radiation therapy by Dr. Bloodgood, and I am sorry my reply did not appear in your issue. You appreciate, of course, that this is not a personal matter, but one of intense interest to all radiologists.

It is singular that radiation therapy should be assailed, for this method of

treatment has been proven a clinical cure for many cancers of the lip, even in instances where such cancers were inoperable. There are, of course, many cases where surgery would be the treatment of choice, but not in the localized small areas under discussion, which can so readily be destroyed by radiation without subjecting the patient to the V-shaped or any other incision.

In most communities, not only the internist but also the surgeon rightly resorts to radiology for cancer of the lip.

Very truly yours,  
ALBERT SOILAND, M.D.

#### INTERNATIONAL CONGRESS OF RADIOLOGY

LONDON, JULY 1, 1925

The Editor is advised by Dr. William H. Stewart, 222 West 79th Street, New York, member of the Arrangement Committee of the International Congress of Radiology, meeting in London, July 1, 1925, that "so much objection was made to the expense of traveling on the *Mauretania* that it was finally decided to change this to a one-cabin boat, and the Committee then decided upon the *America*."

Complete information relative to the revised itinerary may be had upon request from Thomas Cook & Son, 585 Fifth Avenue, New York City, attention of I. I. T. Department.

The members of the Arrangement Committee are Dr. A. C. Christie, Dr. C. Eastmond, Dr. Leopold Jaches, Dr. F. M. Law, and Dr. William H. Stewart.

At the last regular meeting of the Central Illinois Radiological Society the following officers were elected: President, E. G. C. Williams, M.D., Danville; Vice-president, H. C. Kariher, M.D., Champaign; Secretary, C. J. McCullough, Decatur.

# ABSTRACTS OF CURRENT LITERATURE

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**Exophthalmic goiter.**—This is one of the series of papers on studies in metabolism from the Harvard Medical School and allied hospitals.

What is the best way to treat exophthalmic goiter? The investigation of Dr. Holmes and his associates does not try to present a final answer, but only the result of their work thus far. At the time the investigation was begun the operative mortality was higher than at present and X-ray was being recommended enthusiastically. Since their work was begun the re-introduction of the use of iodine has changed the problem somewhat. At present, the conclusions of these authors is that iodination followed by subtotal thyroidectomy is the best procedure for exophthalmic goiter that has yet been advanced. X-ray has its place in the treatment of patients on whom operation is not advisable, or who refuse operation. If the benefit from X-ray is not apparent within four months, it probably will not occur. In about one-third of the cases radiated, no improvement was secured, the other two-thirds showing improvement, while in five patients there was a rapid and striking improvement coinciding exactly with radiation. It is this group that represents the hopeful outlook for radiation therapy in a minority of patients.

W. W. WATKINS, M.D.

*On the Treatment of Exophthalmic Goiter. G. W. Holmes, J. H. Means, C. A. Porter, E. P. Richardson, and M. P. Starr. Boston Med. and Surg. Jour., Aug. 14, 1924, p. 295.*

**Bladder disturbances.**—Almost every woman suffers from bladder disturbances at some period of her lifetime. Residual urine and infection are present in less than one-half of the bladders of pregnant women. Regurgitation of urine is not frequent during pregnancy. Not all bladder disturbances during pregnancy should be ascribed to this physiologic function. Contrary to popular opinion, cystoceles are frequently seen unaccompanied by residual urine or infection. Residual urine is present in 80 per cent of post-partum cases. It is almost always present following operation on the female pelvic organs. Ascending infection is not uncommon. Repeated examination of the upper urinary tract is demanded when the symptoms fail to respond to treatment directed toward the more apparent condition.

The female bladder is more susceptible to direct and reflex influences than that of the male. The two glass test should be more frequently used for the differential diagnosis of urethral and bladder conditions in women. Notwithstanding the marked frequency with which urethral strictures are responsible for bladder disturbances in women, they continue to be overlooked in many instances.

Apparently hopeless cases are sometimes accompanied by associated pathologic conditions, the treatment of which often results in much relief to the patient. Cystography, following the administration of sodium iodid by mouth, as well as by direct injection, is often of great value in the diagnosis of pathologic conditions of the female bladder.

Urology in women is an essential part of urology, and it lies within the domain of the urologist rather than that of the gynecologist, obstetrician or abdominal surgeon.

W. W. WASSON, M.D.

*The Female Bladder.* William E. Stevens and Elizabeth Arthurs. *Jour. A. M. A.*, Nov. 22, 1924, p. 1656.

**Tumor studies.**—The experimental study of cancer really began about 1900 with the discoveries of Jensen and Loeb concerning the relatively easy transplantability of certain tumors of mice and rats from one animal to another. The preferable technic has been found to be that of grafting into the subcutaneous tissue of the axilla of an animal of homologous strain a very small tumor fragment weighing only a few milligrams, by means of a trocar and cannula. The only successful heteroplastic grafts have been made into tissue where the general immunity response is slow and ineffective, giving the heterologous tumor a chance to proliferate for a considerable time.

Transplanted tumors are not exactly the same as the primary tumors of man or animals. They are simply fragments of cancer tissue from one animal growing in a healthy host. The adaptation to the soil is never perfect, but the growth of an inoculated tumor does change the composition of the blood considerably until it is removed or disappears spontaneously. Such alterations occur also in primary tumors in the human being. The transplants have many of the morphologic and biologic qualities of the primary tumor from which they are derived, so that an isolated cell material can be studied with more or less freedom from the complications introduced by the growth processes of the body.

The observation by Loeb that grafted tumors occasionally disappeared for no evident reason led to wide studies without any determination of the underlying causes of the disappearance. Unsuitability of the soil and thrombosis of the vessels of the tumor are among the causes that have been assigned. Naturally, in these studies it was hoped to find hints of value in determining the disappearance of primary tumors—leading up to obtaining a cure. So far, however, artificial regression of a transplanted or primary tumor has not been effected by any means except its physical destruction by radiation or heat. Nevertheless, the use of transplanted tumors has led to the discovery of interesting biologic facts, some of considerable practical importance.

Thus experiments with a metastasizing strain of rat carcinoma suggest that the dangers of biopsy have probably been overestimated, and that this procedure does not increase the frequency of metastasis. On the other hand, it has been demonstrated that gentle massage will distribute a carcinoma throughout the body in a short period. Immediately after massage, the lung capillaries may be found stuffed with cancer cells. At a later time, only two or three developed metastases may be discovered in the lungs, indicating that many cancer cells do not actually develop into tumors.

For our special purposes, another problem to which transplanted tumors are adapted is the determination of the biologic conditions of the destruction of tumor cells by radiation and by heat. The biologic constancy of the death-point has been definitely settled for a group of tumors. It has been found that the quantity of roentgen rays required to kill all the cells of an average animal tumor, when scattered and secondary radiation is eliminated, is approximately five human skin erythema doses. This has been challenged repeatedly by those who are treating human tumors, but recent practical workers are stating that it requires from two to four erythema doses to kill human tumors, whereas some tumors are



even more resistant. Most of the clinical cures obtained in man are probably not due to destruction of all the tumor cells, but to the death of a considerable portion thereof and to the interference with the nutrition and growth of the remainder by the scar tissue that is formed.

Once the lethal point of tumor cells was determined, many problems became soluble immediately. It has been found, for instance, that the same number of human skin erythema doses is necessary to kill a tumor cell, no matter what the filtration or wave length of the roentgen rays or radium. It has also been demonstrated that equal ionization doses of the same wave length kill in the same time and, thirdly, that equal ionization doses of different wave lengths are equally effective. As a by-product of such experiments, the ionization depth curves published by Dessauer have recently been corrected to correspond more closely to the biologic facts. The belief that irradiation closes the lymphatics of the exposed region—advanced as an argument for pre-operative irradiation—has been shattered by experiments on animals, in which the main lymph channels did not close, at least within two or three weeks, after exposure to five human skin erythema doses of roentgen rays. The opinion that the direct effects of irradiation are supplemented by an active destructive effort of the body tissues—local or general—appears improbable from the extraordinary rarity of such an occurrence, only a few hundred authenticated instances being recorded in the last twenty years, during which time millions of persons have died of cancer. If antagonistic forces are available in the body, they should destroy the few remaining cells in a scar, for example, from which a recurrence often takes place years after operation. Cancer grows best in healthy persons and in well vascularized tissue in which the hypothetical antagonistic forces might supposedly be most available. Murphy has shown that irradiation of an area does not prevent tumor implantation, and every experienced radiotherapist will attest that a recurrent cancer of the breast will grow through areas of tissue which have been thoroughly irradiated.

JOSEPH MUIR, M.D.

*The Experimental Pathology of Cancer.* Francis Carter Wood. *Jour. A. M. A.*, Jan. 3, 1925, p. 4.

**Bone lesions.**—This is a case of multiple tuberculous osteomyelitis with both formative and destructive lesions. In 1920 Lovett and Wolbach reported twenty-five cases of bone lesions occurring in children, in which were emphasized the difficulty in differentiating between pyogenic osteomyelitis, tuberculosis and syphilis

from the radiographic appearance. The changes found in bone radiographically may be classed as (1) atrophy or diminution in lime content; (2) local or general destruction of bone tissue; (3) formative process, either of new bone or condensation in existing bone. The three diseases mentioned may share these reactions in varying degrees.

The case reported in this paper was that of a child who developed multiple bone lesions with the characteristics usually associated with syphilis, but which turned out to be tuberculosis. These lesions included periosteal new bone formation along the right tibia above the ankle; the left ulna showed marked periosteal reaction with some destruction in the lower end, with a slight periosteal reaction along the left radius; in the left fibula there was a marked destructive process in the lower end. All of these lesions were tuberculous, proven by histologic examination and by guinea-pig inoculation of scrapings from the bone marrow.

W. W. WATKINS, M.D.

*A Case of Multiple Bone Lesions of Atypical Roentgenographic Appearance, with the Pathologic Findings.* Charles L. Brown and Daniel M. Stiefel. *Jour. Bone and Joint Surg.*, July, 1924, p. 550.

**Method of marking roentgenographs.**—About 25 per cent of standard mucilage acaciae is added to ordinary writing ink. By means of a heavy stub pen, this mixture is used for writing the desired information on a slip of paper. Before the ink is dry, powdered metallic lead (fine filings) is sprinkled on and the excess shaken off, which leaves a thick ribbon of lead enmeshed in the form of writing. The piece of paper is next put alongside the part that is to be roentgenographed and the exposure made in the usual manner, the lead writing taking the place of the ordinary block lead numbers.

J. D. CAMP, M.D.

*Film Marking by a New Method.* Robert B. Taft. *Am. Jour. Roentgenol. and Rad. Ther.*, Oct., 1924, p. 390.

**Cancer treatment.**—Two methods of treatment are outlined: surgery, including electrocoagulation and cautery, and radiation, including radium and X-rays. The surgical results are based on the early cases, because only such are operated on. Choice of treatment depends on the extent of the disease. An early localized lesion is treated equally well by surgery or radiation, a combination probably being best. Borderline or advanced cases are treated exclusively by radiation. Biopsy should be done if needed for diagnosis or prognosis. Pelvic examinations

should be done very carefully and repeated examinations avoided. Do not unduly traumatize the lesion in preparation for radium. Dosage of radium varies from 2,000 to 5,000 mg.h., always well filtered and delivered in as short a time as convenient. Both radium and X-rays are indicated in every case. The tissue reaction is as important a factor in securing results as is the destructive effect on the cancer cells.

W. W. WATKINS, M.D.

*Radium Treatment of Cancer of the Cervix.*  
Clyde O. Donaldson and George E. Knappenberger. *Jour. Okla. St. Med. Assn.*, Aug., 1924, p. 198.

**An aid in measuring and checking.**—The authors constructed a condenser type of ionization chamber and mounted this just below the copper filter, using the ionization chamber as a secondary filter, and connected the ionization chamber through batteries to a Type P galvanometer. The galvanometer is mounted in the booth containing the control stand of the roentgen-ray machine, and the scale is visible to the operator at all times, making it possible to observe continuously the reading of the intensity of radiation after passing through the copper filter. In addition to measuring the intensity of roentgen radiation continuously, the device prevents the omission of a filter or the use of the wrong filter by registering a marked difference in the radiation, on the galvanometer.

J. D. CAMP, M.D.

*A Practical Method of Constantly Measuring the Radiation from a Roentgen Tube, with a Check Against the Omission of Filters.* J. L. Weatherwax and E. T. Leddy. *Am. Jour. Roentgenol. and Rad. Ther.*, Sept., 1924, p. 271.

**The heart.**—(NOTE:—This article represents the viewpoint of a prominent internist of the South, and differs considerably from the usual valuation placed on the value of X-ray in cardiology. For example, Cabot states that it is impossible to outline the heart by percussion and one has only to try it with his eyes shut to see how wide of the mark he will come.—W. W. W.)

The paper discusses the relative value of percussion and X-ray in delineation of the heart borders. It is the consensus of opinion among

the most skillful radiologists that in the diagnosis of heart conditions very limited information is to be found by this means. X-ray has not given a basis on which to determine the normality of the heart size, for the following reasons: only one-third of the circumference of the heart silhouette is shown in radiograph; inability to map lower border of heart; invisibility of heart apex; influence of respiration on size of heart; difficulty in radiographing at proper phase of respiration; influence of other chest shadows in determining heart borders; variability in size of transverse diameter; variations in size in systole and diastole; variability of size, shape and position of heart in different individuals; divergence of rays; extra-cardial structures are included in cardiac silhouette; slipshod technic; size, shape and deformation of chest; changes due to posture; lack of correlation in size of radiologic and anatomical heart.

Accurate percussion has the following advantages: delineation of whole heart; heart accurately made out in size, shape and position; patients percussed in recumbent posture; both transverse and longitudinal diameters available; percussion of heart itself and not the pericardial appendages and foreign structures can be made out; apex can always be made out; shading of dullness and resistance due to a difference in density between fat and cardiac tissues; close approximation in size of the percussed and anatomical heart; correlation of the size of clenched fist and heart; heart area more accurately measured; always available and can be repeated at will.

(NOTE, by abstractor:—The author did not make clear how some of the things can be done by percussion and why they cannot be done by X-ray. A physical examiner who can differentiate by percussion between the heart and the pericardial fat certainly does not need the X-ray to aid him. But radiologists throughout the country know that if kind Nature did not put the heart uniformly in the left chest and the apex beat where it can be felt, physical examiners, as a rule, would have difficulty in finding out whether the heart was in the left chest or the right chest,—by percussion.—W. W. W.)

W. W. WATKINS, M.D.

*Relative Value of Percussion and X-ray in Cardiology.* A. E. Fossier. *New Orleans Med. and Surg. Jour.*, June, 1924, p. 537.

WANTED—Copies of the January and March, 1924, numbers of RADIOLOGY. Will pay fifty cents a copy. Please forward to 402 Guardian Life Bldg., St. Paul, Minn.

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